3101-UM-253

2731

SERVICE MANUAL AND PARTS LIST

for

LINEARCORDER MARK Ⅶ model WR3101

GRAPHTEC CORP.

WESTERN GRAPHTEC

WESTERN GRAPHTEC INC.
Formerly Watanabe Instruments

TO THE USER:

This Service Manual has been updated as follows:

(1) Changes were made to the Mother Board Circuit Diagram (Page 6-1-2) in March, 1984.

(2) Two new circuit diagrams have been added:

(1) Page 6-27-28 - Heat Control Circuit (PCB: 3101-06E (EC))

(2) Page 6-37-38 - Chart Controller (3101-40)

(3) Pages 9-12 have been revised, and the pages inserted before the Table of Contents should be referred to instead of the original pages.

Errata

Please disregard:

(1) Pages 6-26 through 6-28-2 inserted before the Table of Contents

(2) Page 6-36

These were printed in error.

1 July, 1985

Property of:
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* Correetion on the Servce Manual
(3101 – UM – 252) for Linearcoder WR3101

Page 9 to 12 & Page 6 – 26 to 6 – 28 on 3101–UM–252 Please replace pages with these correct ones respectively.

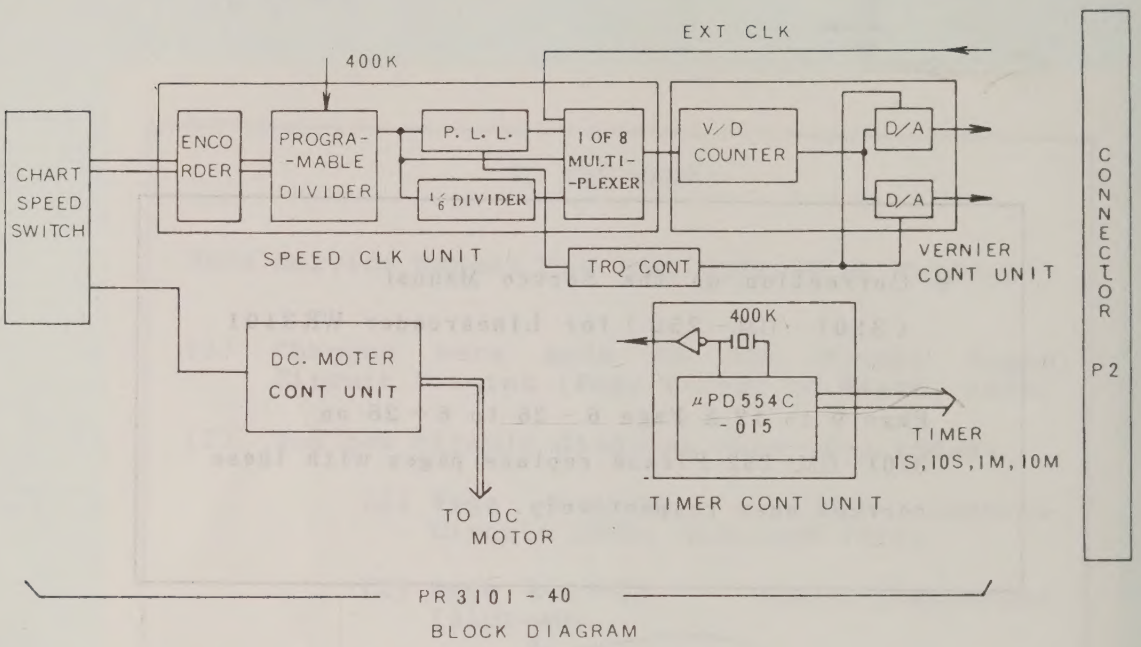
8/5/86 3,300 - mainframe
710ea x 4 ea model 3101 pen motors
260ea x 4 for amplifiers

3300
2840
1040
$7,180 total price

25622

B-642 BE

2.6 Chart Controller



2.6.1 Speed CLK unit

Drives at 400 KHz and outputs CLK in accordance to the specified paper feeding speed.

1 - (1) The frequency output from the PROGRAMABLE DIVIDER is as follows (output pin (9) of IC 2):

SEC button pushed	80 N (Hz)
MIN button pushed	8 N (Hz)

(N stands for the number indicated by the button pushed.)

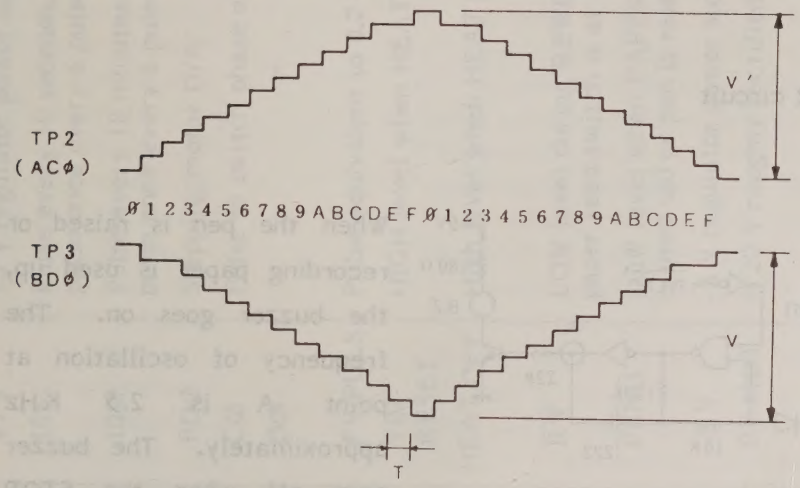
1 - (2) The frequency output from One of Eight of the MULTIPLEXER is as follows (output pin (3) of IC 11):

SEC button pushed	80 N (Hz) (After acceleration is over when speed is 100 mm/sec or more.)
MIN button pushed	4/3 N(Hz)

2.6.2 VERNIER. CONT unit

V/D counts the CLK output from the SPEED CLK unit and outputs a voltage converted for the VERNIER drive of the stepping motor.

Note: TP2, TP3 are set based on TP1.



V' is changeable from about 0.9V by means of VRI. When making adjustments, use VRI and see to it that V is equal to V' (V = V').

T in the above figure is as follows. (N is the number indicated by the button pressed.)

SEC button pushed	T = 1/80N (SEC)
MIN button pushed	T = 3/4N (SEC)

The relationship between SPEED and V is as follows:

SPEED	V
50 mm/sec or less	1.4 V
100 mm/sec	1.8 V
250 mm/sec	2.1 V
500 mm/sec	2.5 V

2.6.3 DC MOTOR CONT unit

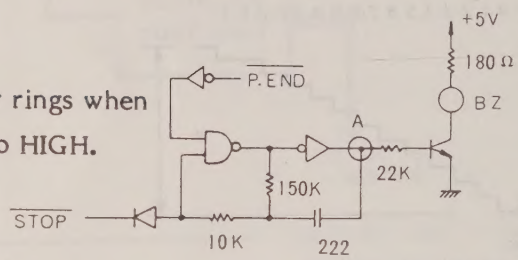
The DC motor is driven by a stabilized current.

2.6.4 TIMER CONT

A 4-bit CPU PD 554C-015 with a program to WATANABE specifications is used. Output pins (2), (3), (4) and (5) output pulses of 1 sec, 10 sec, 1 min and 10 min respectively. Resetting is done when HEAT is OFF.

2.6.5 BUZZER circuit

Buzzer rings when both go HIGH.



When the pen is raised or recording paper is used up, the buzzer goes on. The frequency of oscillation at point A is 2.5 KHz approximately. The buzzer goes off when the STOP button is pressed.

Connection with PR3101-13 CHART DRIVER

Pin No.	Name	Description	Pin No.	Name	Description
A-1	GND	Logic earth	B-1	GND	Logic earth
A-2	+5 V	+5 V regulator power supply	B-2	+5 V	+5 V regulator power supply
A-3	IS	Pulse every second. Double pulse once every 10 pulses.	B-3	10S	Pulse every 10 seconds. Double pulse once every 6 pulses.
A-4	IM	Pulse every 10 minutes. Double pulse once every 10 pulses.	B-4	10M	Pulse every 10 minutes. Double pulse once every 6 pulses.
A-5	$\overline{\text{EXT}}$	LOW level when EXT SW is on.	B-5	BDØ	Stepping motor D/A
A-6	ACØ	Stepping motor D/A	B-6	CØ	Pulse to switch phase of stepping motor.
A-7	AØ	Pulse to switch phase of stepping motor.	B-7	DØ	"
A-8	BØ	"	B-8	FV.PULS	Pulse equivalent to 0.2 mm shift.
A-9	$\overline{\text{CHRT STP}}$	LOW when EXT, CHRT are at STOP.	B-9	TIM RESET	HIGH level when HEAT is OFF.
A-10	CHRT CLK	EXT, CHRT CLK input.	B-10	HEAT OFF	High level when HEAT is OFF.
A-11	P.FEED	Pulse equivalent to 0.4 mm shift.	B-11	$\overline{\text{RW}}$	LOW level during REWIND or when paper feed switch is at STOP.
A-12			B-12	$\overline{\text{PEND}}$	LOW level when PAPER END (paper is used up) or pen is raised.
A-13	-8 V	-8 V regulator power supply.	B-13	-8 V	-8 V regulator power supply.
A-14	PV MOT	20 V roughly rectified power supply.	B-14	PV MOT	≈ 20 V roughly rectified power supply.
A-15	-8 V	-8 V regulator power supply.	B-15		

LED 1 - 3 for checking

LED 1	Goes off when switching button is turned to "sheet paper". When "roll paper" is specified and the paper slackens, this comes on and the feeding speed doesn't go beyond 100 mm/sec.
LED 2	Comes on once every second. Double pulse once every 10 pulses.

Chart Controller

Figures	Part No.	Description	Type	Remarks
IC1	G503300119	IC, CMOS Divide-By-N Counter	TC4018BP	
IC2	A503300100	IC, CMOS Programmable Divider	8650-0	
IC3	A503302051	IC, NMOS Bipolar Memory	MB7056-1	
IC4	A503300118	IC, CMOS Encorder	TC4532BP	
IC5	G503300049	IC, PMOS Micro Computer	μPD554C-015	
IC6	G503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC7	A503301035	IC, CMOS MONO MULTI	HD14538B	
IC8	G503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC9	A503302050	IC, CMOS Quad Exclusive-OR	HD14070B	
IC10	A503302049	IC, CMOS Phase Locked Loop	HD14046B	
IC11	G503300113	IC, CMOS 8CH Multiplexer	TC4051BP	
IC12, 13	G503300107	IC, CMOS Binary U/D Counter	TC4029BP	
IC14	A503302052	IC, NMOS Bipolar Memory	MB7056-2	
IC15	G503301009	IC, Op Amp Quad	μPC324C	
IC16	G503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC17	G503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC18	G503300052	IC, CMOS Quad Bilateral Switch	TC4066BP	
IC19	G503301009	IC, Op Amp Quad	μPC324C	
Q1~4	G503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q5	G503203016	T, PNP −30V −100mA 200mW	2SA1015, Y	
Q6	G503200007	T, PNP −50V −3A 1.5W	2SB434, O	
Q7	G503200015	T, NPN 50V 3A 1.5W	2SD234, O	
CR1~11	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR12	G503100060	Di, Si 5.2V 0.5W ±5%	WZ052	
CR13~24	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR25	G503100006	Di, Si 12V 0.5W ±5%	WZ120	
CR26, 27	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR28	G503100060	Di, Si 5.2V 0.5W ±5%	WZ052	
CR29	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
LED 1, 2	A503100080	Di, LED Red I_F = 25mA	TLR102A	
R1	G501810422	R, Metal Film 22K 1/4 ±1%	RN1/4-22KF	
R2	G501810412	R, " 12K 1/4 ±1%	RN1/4-12KF	
R3	G501810422	R, " 22K 1/4 ±1%	RN1/4-22KF	
R4	G501810412	R, " 12K 1/4 ±1%	RN1/4-12KF	
R5	G501810310	R, " 1K 1/4 ±1%	RN1/4-1KF	
R6	G501810315	R, " 1.5K 1/4 ±1%	RN1/4-1.5KF	
R7	G501810510	R, " 100K 1/4 ±1%	RN1/4-100KF	
R8	G501810218	R, " 180 1/4 ±1%	RN1/4-180F	
R9	G501810510	R, " 100K 1/4 ±1%	RN1/4-100KF	
R10	G501810422	R, " 22K 1/4 ±1%	RN1/4-22KF	
R11	G501810510	R, " 100K 1/4 ±1%	RN1/4-100KF	

Figures	Part No.	Description				Type	Remarks
R12	G501810422	R, Metal Film	22K	1/4	±1%	RN1/4-22KF	
R13	G501810339	R, "	3.9K	1/4	±1%	RN1/4-3.9KF	
R14	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R15	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R16	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R17	G501810210	R, "	100	1/4	±1%	RN1/4-100F	
R18	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R19~22	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R23	G501810175	R, "	75	1/4	±1%	RN1/4-75F	
R24	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R25	G501810482	R, "	82K	1/4	±1%	RN1/4-82KF	
R26	G501810610	R, "	1M	1/4	±1%	RN1/4-1MF	
R27	G501810412	R, "	12K	1/4	±1%	RN1/4-12KF	
R28	G501810324	R, "	2.4K	1/4	±1%	RN1/4-2.4KF	
R29	G501810415	R, "	15K	1/4	±1%	RN1/4-15KF	
R30	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R31, 32	G501810415	R, "	15K	1/4	±1%	RN1/4-15KF	
R33	G501810333	R, "	3.3K	1/4	±1%	RN1/4-3.3KF	
R34	G501810391	R, "	9.1K	1/4	±1%	RN1/4-9.1KF	
R35	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R36	G501810333	R, "	3.3K	1/4	±1%	RN1/4-3.3KF	
R37, 38	G501810351	R, "	5.1K	1/4	±1%	RN1/4-5.1KF	
R39	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R40	G501810368	R, "	6.8K	1/4	±1%	RN1/4-6.8KF	
R41	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R42	G501810347	R, "	4.7K	1/4	±1%	RN1/4-4.7KF	
R43	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R44	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R45	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R46	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R47	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R48	G501810215	R, "	150	1/4	±1%	RN1/4-150F	
R49	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R50	G501810436	R, "	36K	1/4	±1%	RN1/4-36KF	
R51	G501810447	R, "	47K	1/4	±1%	RN1/4-47KF	
R52	G501810533	R, "	330K	1/4	±1%	RN1/4-330KF	
R53	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R54	G501810533	R, "	330K	1/4	±1%	RN1/4-330KF	
R55	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R56	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R57	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R58	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R59	G501810520	R, "	200K	1/4	±1%	RN1/4-200KF	
R60	G501810456	R, "	56K	1/4	±1%	RN1/4-56KF	
R61	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	

Figures	Part No.	Description				Type	Remarks
R62	G501810422	R, Metal Film	22K	1/4	±1%	RN1/4-22KF	
R63	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R64	G501810456	R, "	56K	1/4	±1%	RN1/4-56KF	
R65	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R66, 67	A501604703	R, "	220	1/2	±5%	RSF1/2B-220J	
R68	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R69	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R70	A501609728	R, Wirewound	10,	5,	±5%	CS5P-10J	For 2, 4CH
	A50160729	R, Wirewound	8.2,	5,	±5%	CS5P-8.2J	For 6CH
	A50160730	R, "	6.8,	5,	±5%	CS5P-6.8J	For 8CH
	A50160731	R, "	5.6,	5,	±5%	CS5P-5.6J	For 12CH
R71	G501810227	R, Metal Film	270	1/4	±1%	RN1/4-270F	
RA1	A501003334	Resister Arrey				EXB-P8-8-103J	
RA2	A501003332	Resister Arrey				EXB-P8-8-222J	
RA3, 4	A501003333	Resister Arrey				EXB-P8-8-124J	
VR1	G505103026	R, Trimmer Cermet	5K			GF6P-5K	
C1~6	G502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C7	G502203013	C, Tantalum	1μ	35WV		CS15E1V010M	
C8	A502102064	C, Electrolytic	47μ	10WV		ECEA1AS470	
C9	G502203003	C, Tantalum	3.3μ	16WV		CS15E1C3R3M	
C10	A502403028	C, Ceramic	2200P	50WV		UFD04SA222J-L2A	
C11, 12	G502303002	C, Myler Film	0.001μ	50WV		MFL-05D1	
C13, 14	A502703021	C, Mica	33P	100WV		Z05-100V33P	
C15	A502102064	C, Electrolytic	47μ	10WV		ECEA1AS470	
C16, 17	A502102029	C, "	47μ	16WV		ECEA1CS470	
C18	G502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C19	A502303019	C, Myler Film	0.0015μ	50WV		MFL-05D15	
C20, 21	G502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C22, 23	G502203002	C, Tantalum	10μ	16WV		CS15E1C100M	
C24	G502303001	C, Myler Film	0.0022	50WV		MFL-05D22	
C25	A502303019	C, "	0.0015μ	50WV		MFL-05D15	
C26	G502303004	C, "	0.01μ	50WV		MFL-05S1	
C27	G502303005	C, "	0.047μ	50WV		MFL-05S47	
TP1~3	B513400027	Check Pin				LC-1-G	
BZ	A519300001	Buzzer				SD161201	
X1	A519105001	X Crystal Oscillator		400KHz		HC-6/UW-400KHz	
S1	A508201013	Switch Push Non-Lock				KSD1-2-ONLDC	
S2, 3	A508213001	Switch Push Lock				KSD2-4-10LLDC	
S4~10	A508207001	Switch Push Lock				KSD7-14-10ILDC	
S11	A508201013	Switch Push Non-Lock				KSD1-2-ONLDC	

Figures	Part No.	Description	Type	Remarks
P1	G513400045	Connector Pin Header 5P	HNC2-2.5P5DSL	
P2	A513301010	" 30P	PS30PED4T1PN1	
FCA	A520110060	Flat Cable With Connector 30 PIN 42mm	L42-30P	
P1001	G513200101	Connector Plug 1P	1625-1P-1	
PIN	G513400001	Connector Pin	1854TL	
P.C.B.	A511310310	Printed Circuit Board	3101-40	
	B516100020	Cap Black	B911	x 10
	A516100025	Cap Ivory	B201	
	B508201007	Spacer	IP-10	x 11

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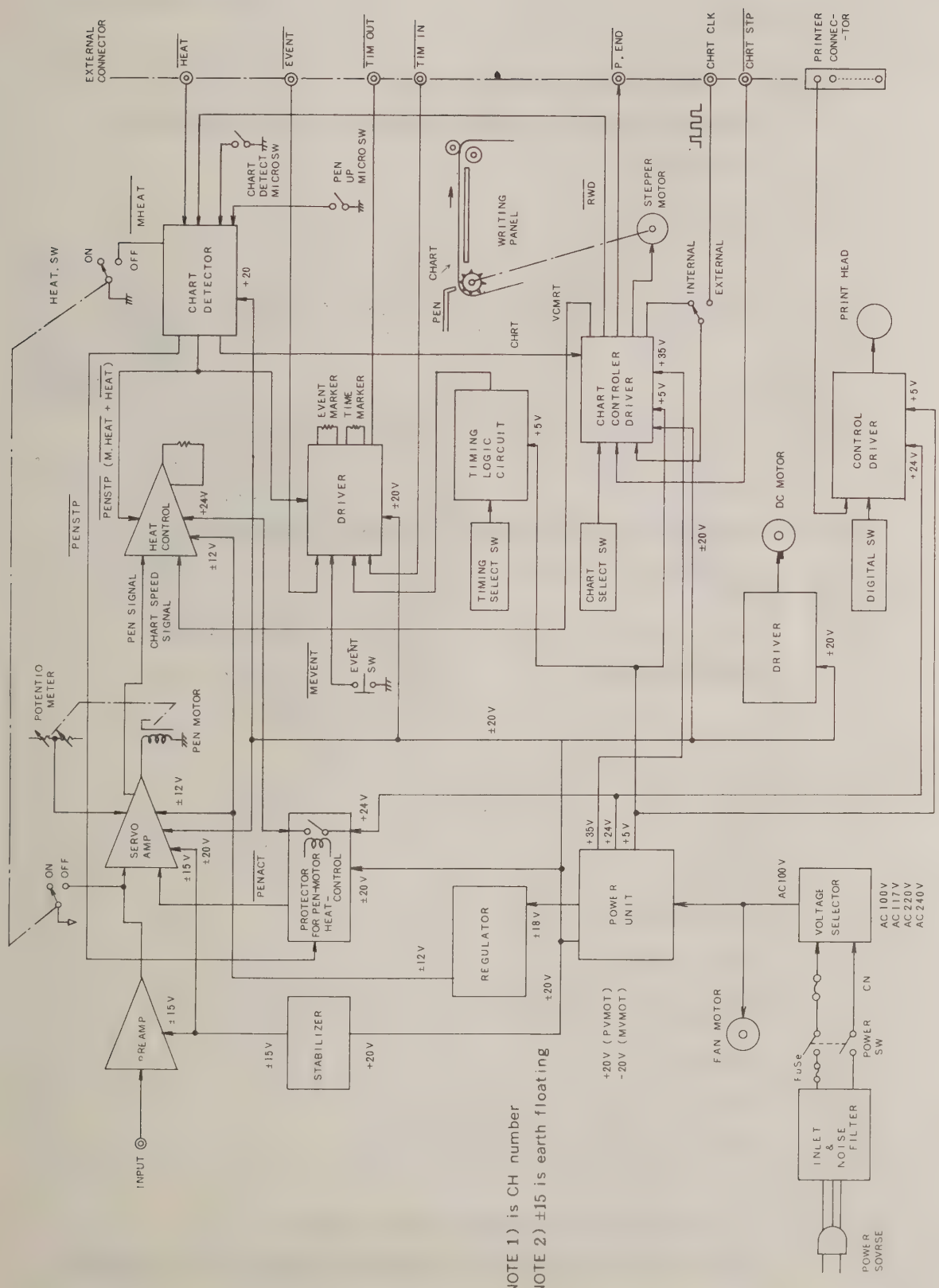
1. Block diagram



2. Outline of the operation of each block

2.1 Power unit

(1) Input: 100 V, 117 V, 220 V, 240 V AC
(selected through the voltage selector on the base plate of the recoder)

(2) Output:

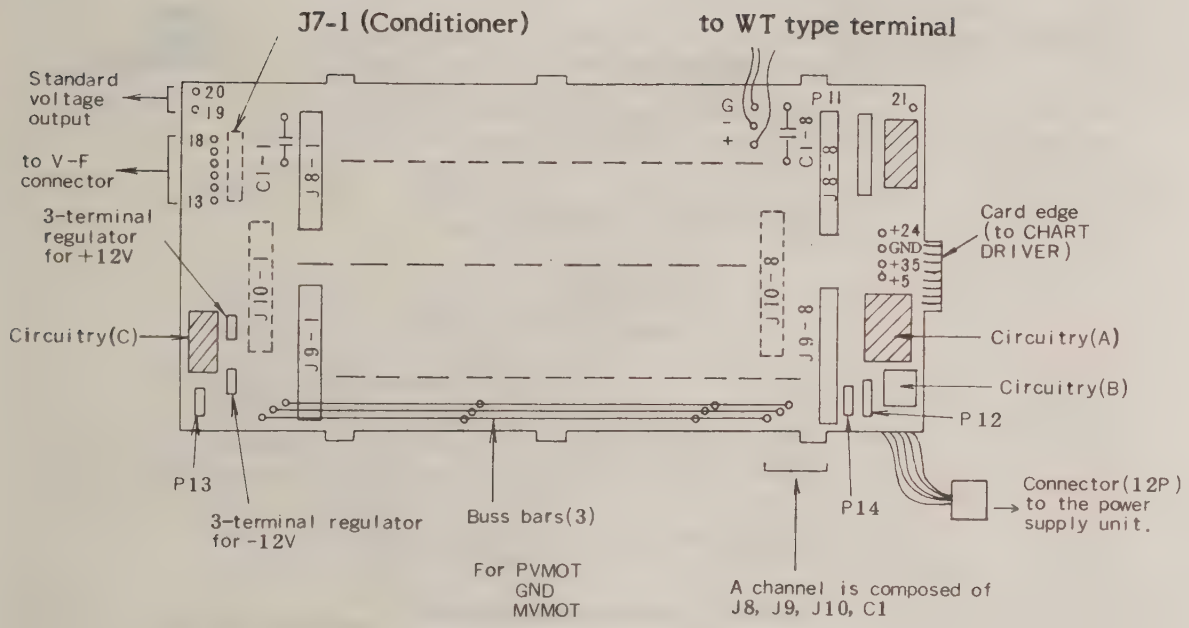
Circuit signal	Meaning	For AC 100 V input			
		Output specification	Unloaded voltage	Ripple	Voltage regulation range (load status)
PV MOT	Power supply for pen motor (+), +20 V	+16 V,10 A (+20 V)	22.5 V	Half-wave capacity 10 A load	+16.6 - +22.5
MV MOT	Power supply for pen motor (-), -20 V	-16 V, 10 A (-20 V)	-22.5 V	3 V p-p	- 16.6 - -22.5
+35	Power supply for stepping motor	+35 V, 2.5 A	42.5 V	2.5 V p-p at 2.5 A load	+33 - +39
+24	For heat pen and printer head	+24 V, 5 A	23.7 V		±1%
+18	For +12 V, 3-terminal regulator	+18 V, 0.5 A	26 V	2.7 V p-p at 400 mA load	+20.5 - +23.3
+5	For paper feed control, logic	+5 V, 1 A	5 V		2%
-18	Input for -12 V, 3-terminal regulator	-18 V, 0.5 A	-26 V	2.7 V p-p at 400 mA load	-20.8 - -23
GND	GND for PV MOT, MV MOT, +35, +24				
SGND	GND for +18, -18, +5				

Note: +5 V and +24 V are stabilized by series regulator.
100 V AC for fan drive (fan is not available in the 2 ch, 4 ch versions)

2.2 Mother board

2.2.1 Construction

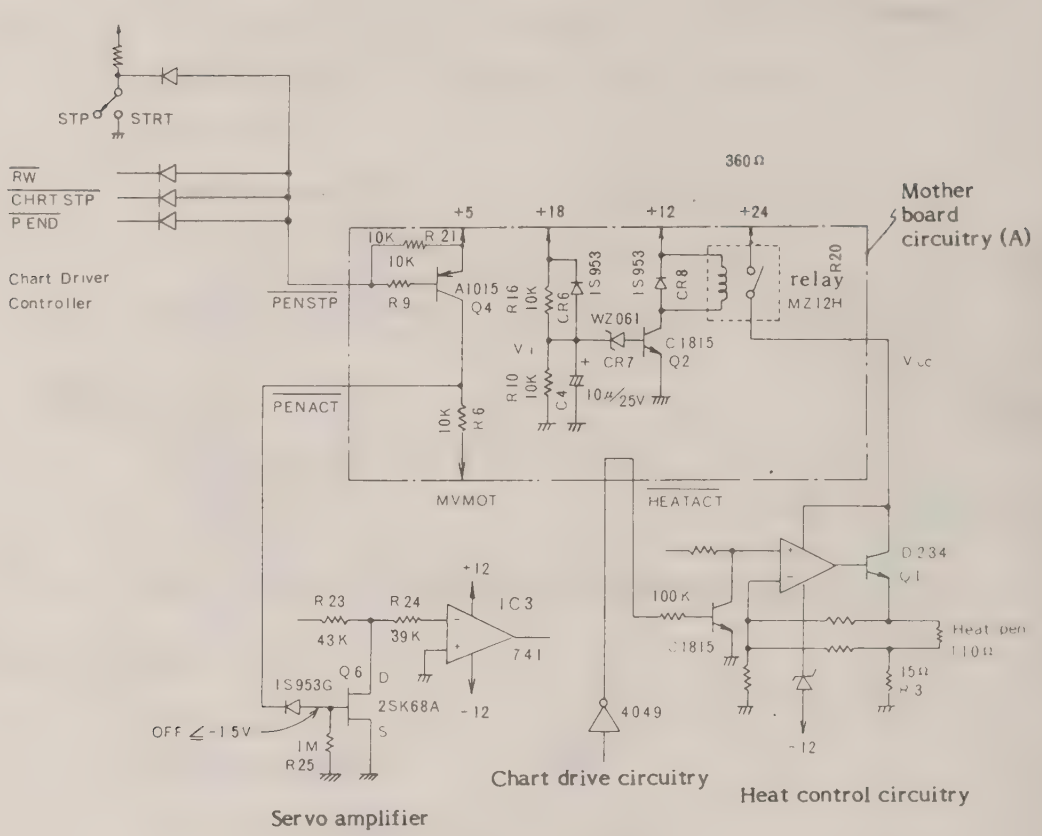
1) Basic construction



Arrangement of parts on 8 CH mother board

2.2.2 Explanation of operation

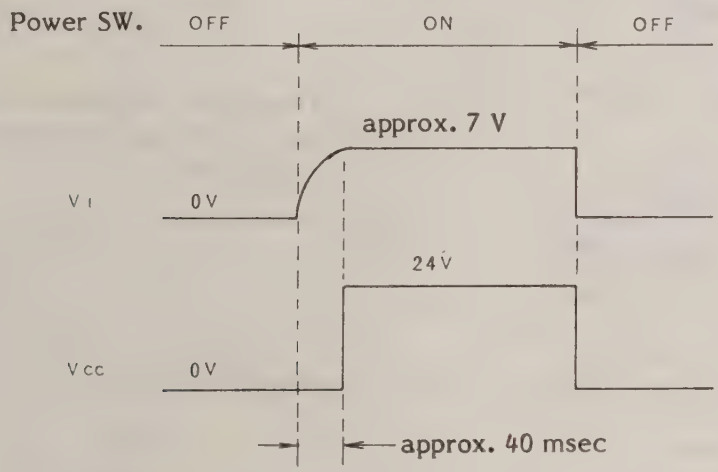
1) Circuitry (A)



(a) This circuitry, in its normal state, receives the signal from the chart drive circuitry (PEN STP) and inputs a "0" to the pen motor drive circuitry (IC3) when: (1) paper feed switch is turned to STOP, (2) paper is rewinding, (3) paper is used up, or (4) pen is up.

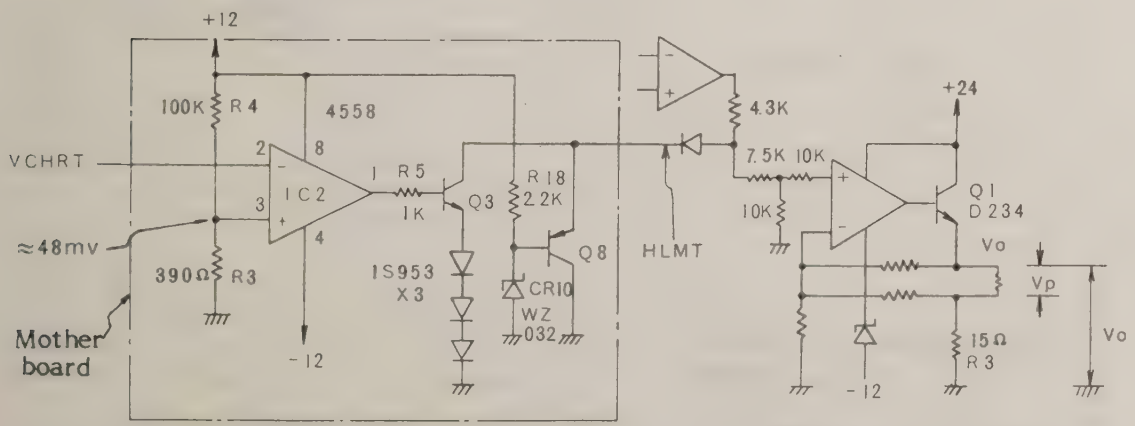
(b) This circuitry prevents excessive voltage being applied to the heat pen when power is being turned on/off. The timing chart is as shown below.

Signal name		
$\overline{\text{PEN STP}}$	Input	o Pen motor operates when at HIGH level. o No torque applied to pen motor when at LOW level.
$\overline{\text{PEN ACT}}$	Output	o Pen motor operates when over -1.5 V. o No torque applied to pen motor when below -1.5 V.
$\overline{\text{HEAT ACT}}$	Output	o Heat pen usable when below 0.6 V. o Heat pen can't be used when over 0.6 V.



2) Circuitry (B)

When the paper feeding speed is below 19 mm/sec. and the pen is being moved at a high frequency, this circuitry prevents a voltage exceeding 8 V being applied to the pen heater.

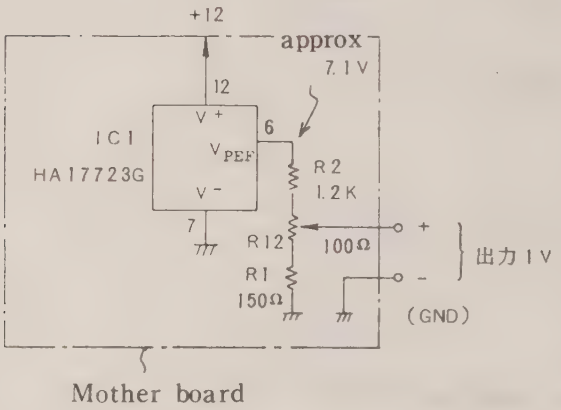


Heat control circuitry

VCHRT is the signal to specify paper feeding speed by a voltage which is proportional to the paper feeding speed. (250 mV = 100 mm/s)

Paper feed speed	IC 2 output	Q3	HLMT	Voltage of heat pen + side (GND)
Below 19 mm/sec.	+10 - +12 V	ON	+2.3 V (approx.)	$V_o \fallingdotseq 8$ V ($V_p \fallingdotseq 7$ V)
Above 19 mm/sec.	-10 - -12 V	OFF	+3.9 V (approx.)	$V_0 \fallingdotseq 13$ V ($V_p \fallingdotseq 11$ V)

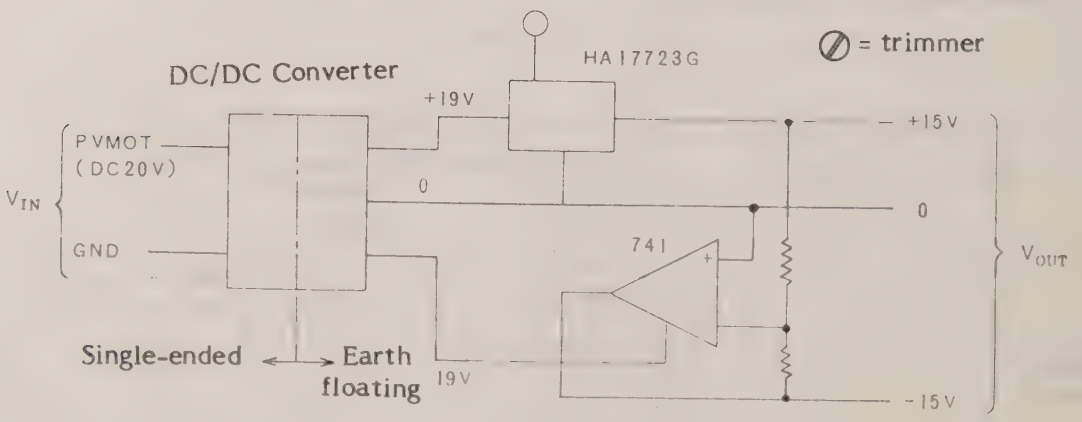
3) Circuitry (C)



Generates a standard voltage of +1 V. Output resistance is about 200 Ω.

2.3 Stabilizer

2.3.1 Block diagram

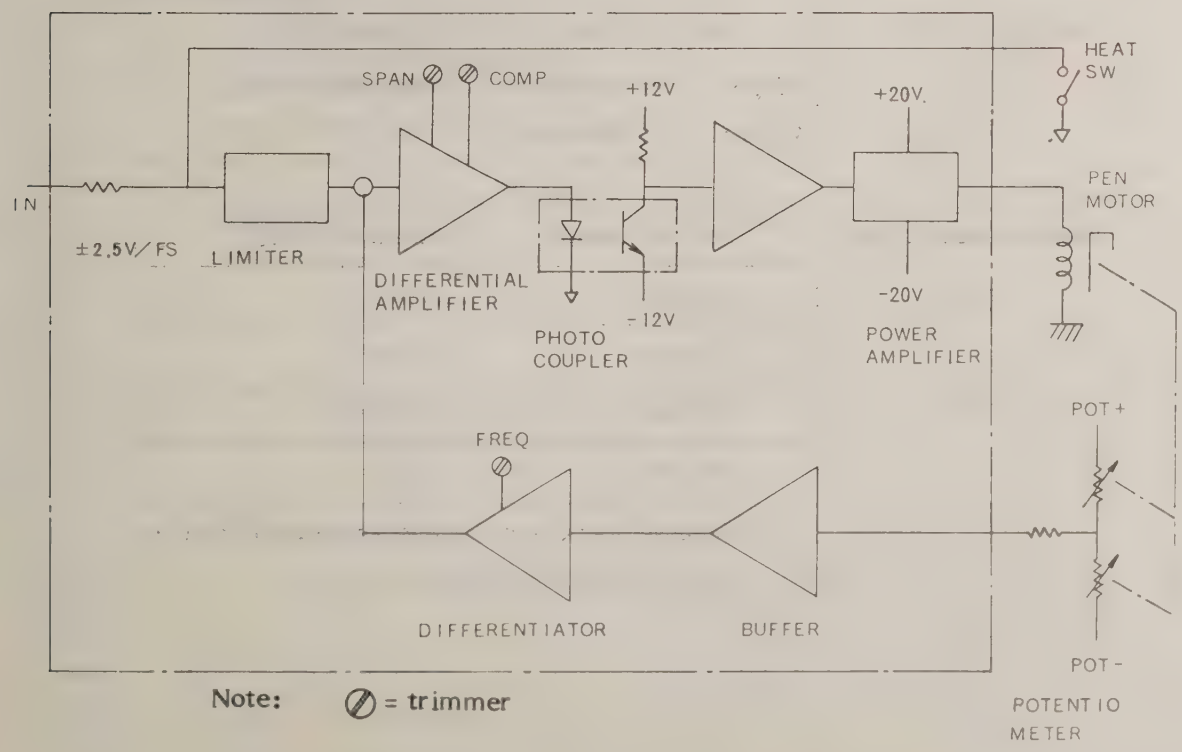


2.3.2 Contents

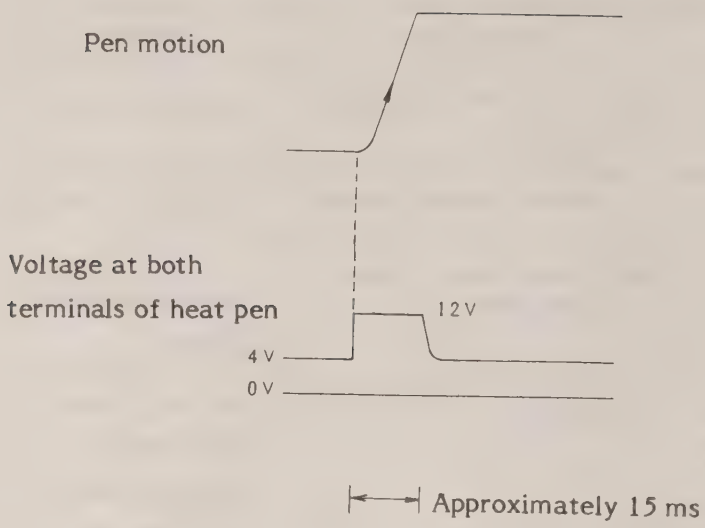
Item		Specification	Remarks
Input voltage	V IN	11 - 24 V DC (Single line earthing)	
Input power	P IN	±45 mA loaded: 2.8 W TYP ±5 mA loaded: 0.8 W TYP	
Output voltage	V OUT	±15 V ±20%	Possible to set to ±0.1%
Max. output current	MAX I OUT	±45 mA	+34 mA, -29mA TYP when pre-amplifier, servo amplifier and heater circuitry operating.
Remaining ripple		About 7 mV p-p (100 KHz)	Standard load

2.4 Servo Amplifier (including pen motor, potentiometer)

2.4.1 Block diagram



2.5 Heat control circuitry



Values typical of pen position signal and paper feeding speed signal are as follows:

Pen position signal

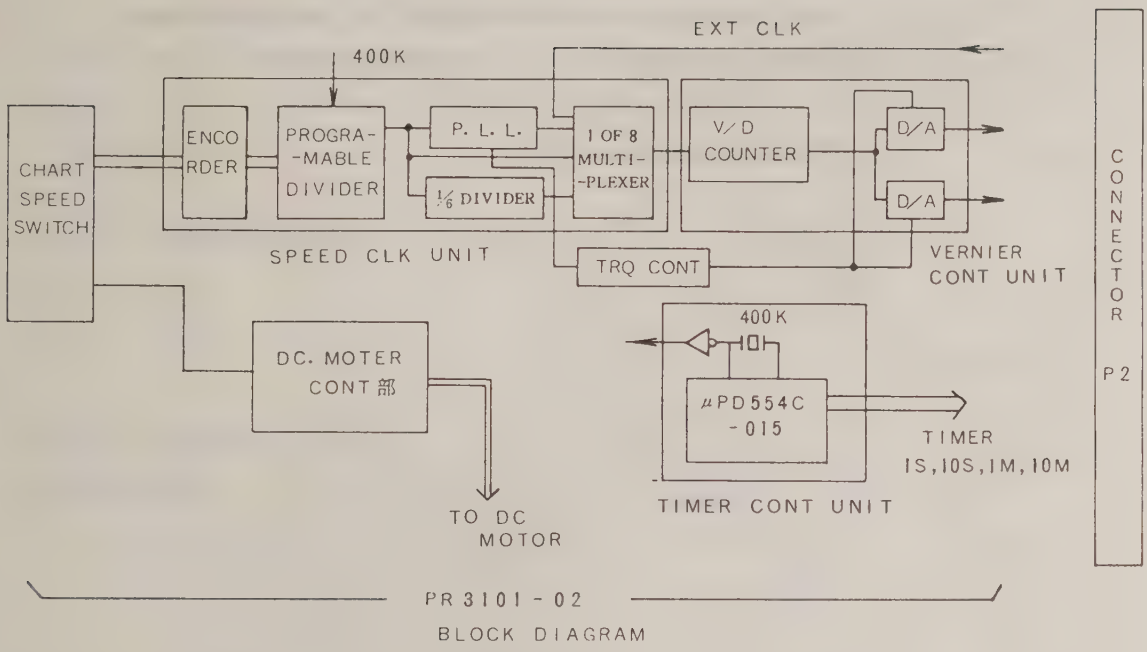
Pen amplitude		Voltage POTC
S type	40 mm p-p	(700 ±230) mV p-p
W type	80 mm p-p	

Feeding speed signal

Feeding speed	Voltage VCHRT
10 mm/s	25 mV
50 mm/s	125 mV
100 mm/s	250 mV
500 mm/s	1.25 V

Feeding speed and voltage are proportional to each other in the other cases too.

2.6 Chart Controller



2.6.1 Speed CLK unit

Drives at 400 KHz and outputs CLK in accordance to the specified paper feeding speed.

1 - (1) The frequency output from the PROGRAMABLE DIVIDER is as follows (output pin (9) of IC 7):

SEC button pushed	40 N (Hz)
MIN button pushed	4 N (Hz)

(N stands for the number indicated by the button pushed.)

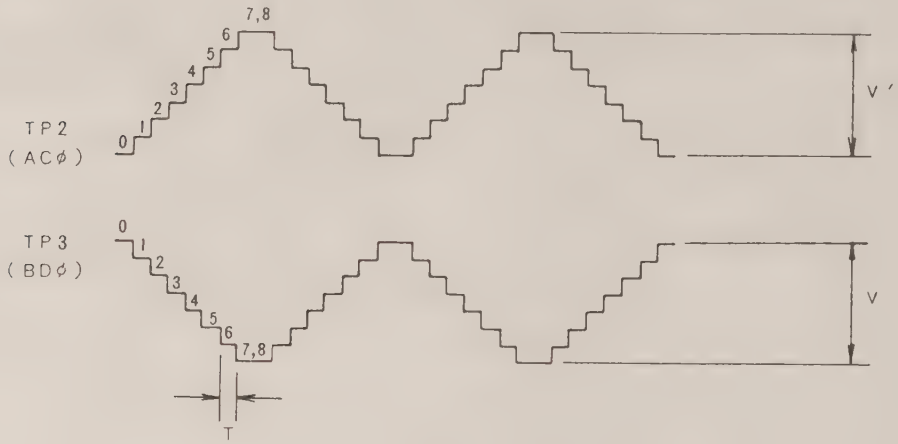
1 - (2) The frequency output from 1 of 8 of the MULTIPLEXER is as follows (output pin (3) of IC 14):

SEC button pushed	40 N (Hz) (After acceleration is over when speed is 100 mm/sec or more.)
MIN button pushed	2/3 N(Hz)

2.6.2 VERNIER. CONT unit

V/D counts the CLK output from the SPEED CLK unit and outputs a voltage converted for the VERNIER drive of the stepping motor.

Note: TP2, TP3 are set based on TP1.



V' is changeable from 0V by means of VRI. When making adjustments, use VRI and see to it that V is equal to V' (V = V').

T in the above figure is as follows. (N is the number indicated by the button pressed.)

SEC button pushed	T = 1/40N (SEC)
MIN button pushed	T = 3/2N (SEC)

The relationship between SPEED and V is as follows:

SPEED	V
50 mm/sec or less	1.3 V
100 mm/sec	1.6 V
250 mm/sec	1.8 V
500 mm/sec	2.1 V

2.6.3 DC MOTOR CONT unit

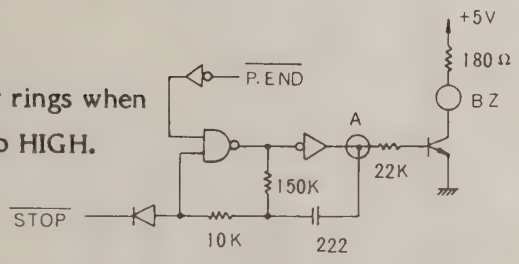
The DC motor is driven by a stabilized current.

2.6.4 TIMER CONT

A 4-bit CPU PD 554C-015 with a program to WATANABE specifications is used. Output pins (2), (3), (4) and (5) output pulses of 1 sec, 10 sec, 1 min and 10 min respectively. Resetting is done when HEAT is OFF.

2.6.5 BUZZER circuit

Buzzer rings when both go HIGH.



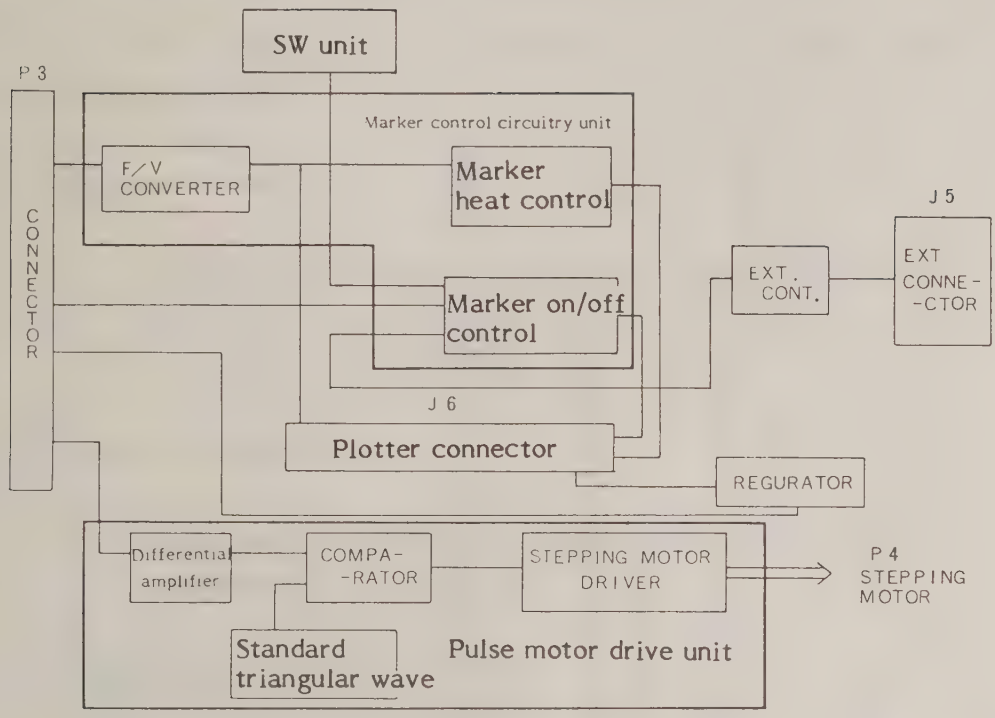
When the pen is raised or recording paper is used up, the buzzer goes on. The frequency of oscillation at point A is 2.5 KHz approximately. The buzzer goes off when the STOP button is pressed.

Pin No.	Name	Description	Pin No.	Name	Description
A-1	GND	Logic earth	B-1	GND	Logic earth
A-2	+5 V	+5 V regulator power supply	B-2	+5 V	+5 V regulator power supply
A-3	IS	Pulse every second. Double pulse once every 10 pulses.	B-3	10S	Pulse every 10 seconds. Double pulse once every 6 pulses.
A-4	IM	Pulse every 10 minutes. Double pulse once every 10 pulses.	B-4	10M	Pulse every 10 minutes. Double pulse once every 6 pulses.
A-5	$\overline{\text{EXT}}$	LOW level when EXT SW is on.	B-5	BDØ	Stepping motor D/A
A-6	ACØ	Stepping motor D/A	B-6	CØ	Pulse to switch phase of stepping motor.
A-7	AØ	Pulse to switch phase of stepping motor.	B-7	DØ	"
A-8	BØ	"	B-8	FV.PULS	Pulse equivalent to 0.2 mm shift.
A-9	$\overline{\text{CHRT STP}}$	LOW when EXT, CHRT are at STOP.	B-9	TIM RESET	HIGH level when HEAT is OFF.
A-10	CHRT CLK	EXT, CHRT CLK input.	B-10	HEAT OFF	High level when HEAT is OFF.
A-11	P.FEED	Pulse equivalent to 0.4 mm shift.	B-11	$\overline{\text{RW}}$	LOW level during REWIND or when paper feed switch is at STOP.
A-12			B-12	$\overline{\text{PEND}}$	LOW level when PAPER END (paper is used up) or pen is raised.
A-13	-8 V	-8 V regulator power supply.	B-13	-8 V	-8 V regulator power supply.
A-14	PV MOT	20 V roughly rectified power supply.	B-14	PV MOT	≈ 20 V roughly rectified power supply.
A-15	-8 V	-8 V regulator power supply.	B-15	MV MOT	≈ -20 V roughly recified power supply.

LED 1 - 3 for checking

LED 1	Pulse switching the phase of the pulse motor. Comes on. Used for checking the action of the pulse motor.
LED 2	Goes off when switching button is turned to "sheet paper". When "roll paper" is specified and the paper slackens, this comes on and the feeding speed doesn't go beyond 100 mm/sec.
LED 3	Comes on once every second. Double pulse once every 10 pulses.

2.7 Chart driver



2.7.1 Marker control circuit

Timer is MONO, MULTI. The double pulses are erased by TC 4528. The pulse width can be varied by the timer setting as shown below in Fig. 2.

Note: Since TC 4528 can be retriggered, when a double pulse is output, it is lengthened by 280 ms approximately in the 10 sec, 1 min and 10 min cases.

Table I Marker COM terminal voltage (TP3) vs. SPEED

Chart speed	Marker COM voltage
10 mm/sec	≈ 8.0 V
100 mm/sec	≈ 10.0 V
250 mm/sec	≈ 14.5 V
500 mm/sec	≈ 17.0 V

Table II Timer select vs. ACTIVE TIME

Timer select	Active time
1 sec	≈ 250 ms
10 sec	≈ 800 ms
1 min	≈ 4.2 s
10 min	≈ 8.2 s

2.7.2 EXT. IN OUT control unit

EXT. connector

Pin No.	Name	IN.OUT.LEVEL	Description
1	$\overline{\text{P.END}}$	OUT LOW ACTIVE	LOW output when paper is used up or pen is raised.
2	$\overline{\text{EVENT}}$	IN LOW ACTIVE	EVENT switch and OR
3	$\overline{\text{TIM OUT}}$	OUT LOW ACTIVE	Synchronism output of timer (master)
4	$\overline{\text{TIM IN}}$	IN NEGATIVE EDGE	Timer input possible from TIMING SW EXT (slave facility).
5	$\overline{\text{HEAT}}$	IN LOW ACTIVE	HEAT SW and OR.
6	CHRT STP	IN HIGH ACTIVE	ON when current is flowing. Priority given to STOP switch.
7	CHRT CKL	IN PULSE	Enabled when EXT. SW is on. 0.025 mm/1 pulse. Only up to 2 KHz.
8	GND		Logic, earth
9	GND		"
10	GND		"
11	GND		"
12	GND		"
13	NC		"
14	+5 V		Output resistance 10 KΩ.

2.7.3 Stepping motor driver unit

1Ω (3W) resistor for current detection is used to make a fixed current closed circuit.

(1) Differential amplifier

Amplifies the difference between the analog-converted-voltage in the chart controller and the voltage at both ends of the resistor to detect the stepping motor's current.

(2) Standard triangular wave

Stabilizes the switching frequency of the current passed into the motor coil.

(3) Comparator

Compares the differential amplifier's output and the standard triangular wave and fixes the "switch on" time of the current motor coil.

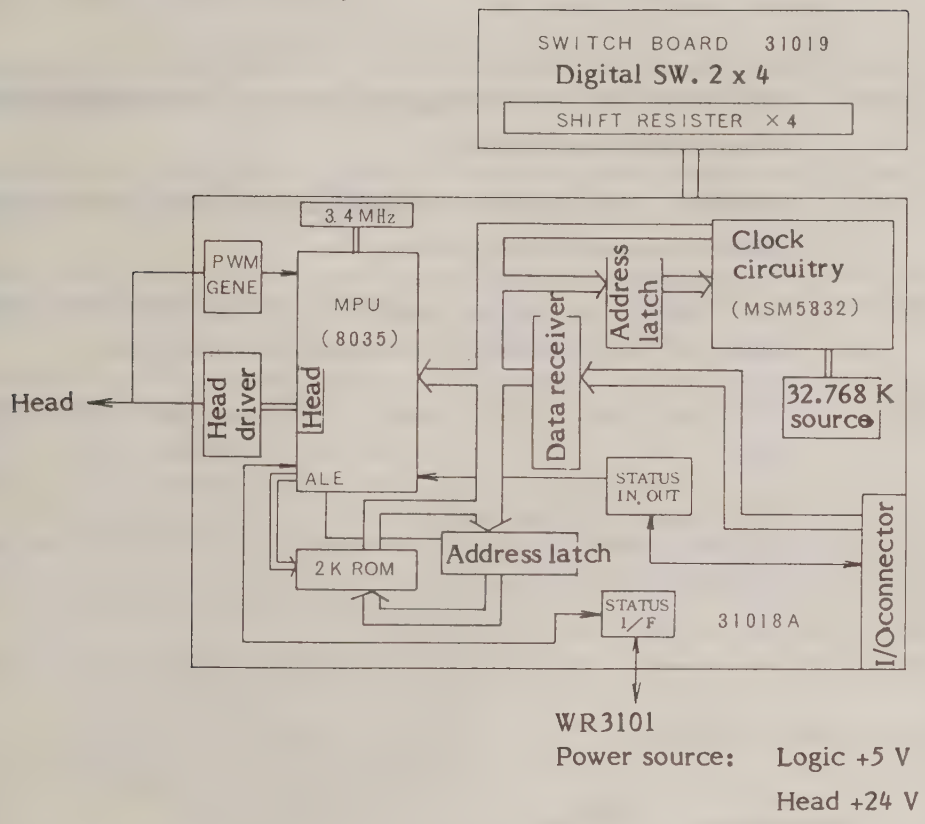
(4) Driver

Passes current into the motor coil.

2.7.4 Connection to the LINEARCORDER

Pin No.	Name	IN/OUT	Description
A1	GND		
B1	GND		
A2	PV MOT		≈+20 V roughly rectified power supply.
B2	MV MOT		≈-20 V "
A3	+5 V		+5 V regulated power supply.
B3	PLV		≈+35 V roughly rectified power supply.
A4	VP 1	IN PULSE	Functions the same as OPTION, V/F unit, external (HR) CLK.
B4	EXT	OUT LEVEL	LOW output when EXT switch is off.
A5	EVENT 1		EVENT ON switch.
B5	EVENT 2		EVENT OFF switch.
A6	TIM 1		TIMING ON switch.
B6	MRK C	OUT LEVEL	Marker applied voltage.
A7	TIM 2		TIMING OFF switch.
B7	PRT ON	OUT LEVEL	Print on when HIGH.
A8	P FEED	OUT PULSE	Control of printed dot spacing. 0.4 mm/pulse
B8	1 SEC	OUT PULSE	Pulse once a second.
A9	$\overline{\text{HEAT}}$	OUT LEVEL	HEAT ON when LOW.
B9	V CHRT	OUT LEVEL	Voltage proportional to chart speed. STOP; Ø V → 500 mm/sec; 1.25 V approx.
A10	MICRO	OUT LEVEL	LOW when pen is raised or paper is used up.
B10	$\overline{\text{PEN STP}}$	OUT LEVEL	Pen motor input is ON when output is LOW.

2.8 Printer control circuitry



(1) SWITCH BOARD

KP	Key preset; stores the contents of SWITCH in the shift register.
SP	Shift pulse; shifts the contents of the shift register one by one to SD's terminal and outputs them.
SD	Serial data.

(2) Clock circuitry

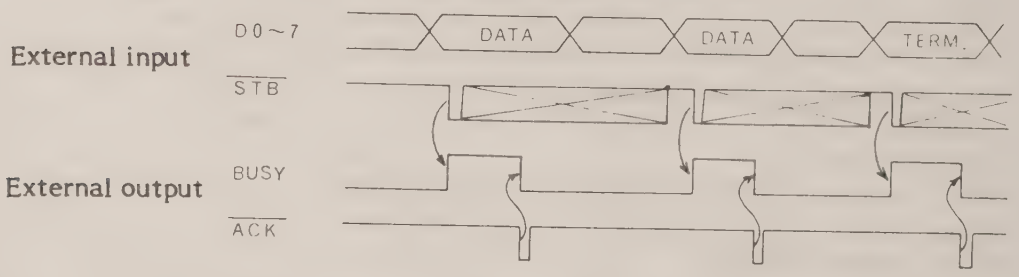
Works from 32.768 KHz source. Outputs year, month, day, hour.

(3) Connection to the printer

P FEED	Pulse to fix the dot spacing; 0.4 mm shift on recording paper every pulse (0.4 mm/pulse).
1 SEC	Pulse/sec. For convertion of pulse number when paper feeding speed is externally controlled.
PRT ON	Turns on/off the voltage applied to the printer. ON when HIGH, and in digital switch read mode only when LOW.
EXT	HIGH level when in EXT mode. LOW level when not in EXT mode.
+24 V	Power supply for print head drive.
+5 V	Logic power supply.
GND	0 V

(4) External interface

Input signals: $\overline{STB}$, DØ - 7.
Output signals: BUSY, $\overline{BUSY}$, $\overline{ACK}$.
Based on Centronix system. Input sequences are as follows.



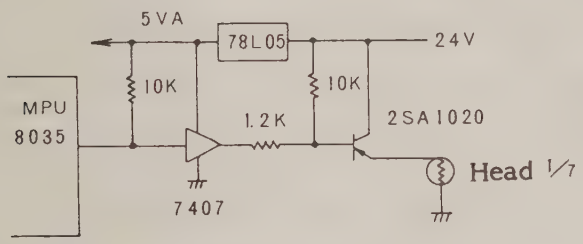
Note: $\overline{ACK}$: pulse width is typically 2/1s. Data should be maintained until $\overline{ACK}$ output is finished. Terminator is LF or CR.

(5) MPU 8035

Upon receipt of signals (1) - (4) above, MPU 8035 proceeds according to the data stored in the 2 Kbyte ROM.

(6) Print head protection circuit

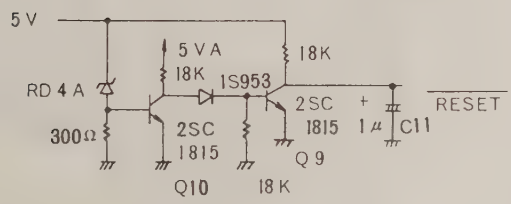
+5 V is regulated by the 24 V power supply for the protection of the input sequence of the head drive and logic power supply.



Print head protection circuit

(7) MPU RESET circuitry

Until the logic power supply (5 V) exceeds 4.6 V, transistor Q8 is cut off and Q9 is on. The MPU is reset.



Precautions to take when using an external CPU:

(1) Confirm the sequence of external interface (based on Centronix) in (4) above.

(2) Confirm that a terminator CR or LF follows the output character string.

(3) Confirm that there is no transmission of data not included in the chart of permissable ASCII codes.

(4) The correct printing of data not included in the chart is not guaranteed.

Table 68-digit code for Alphanumeric and Katakana characters

Rank / Line	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
0	NUL	TC_7(DLE)	(SP)(3)	0	@	P	、	p	↑	↑	Unde cided	—	タ	ミ	↑	↑
1	TC_1(SOH)	DC_1	!	1	A	Q	a	q	⋮	⋮	。	ア	チ	ム	⋮	⋮
2	TC_2(STX)	DC_2	〃	2	B	R	b	r	⋮	⋮	「	イ	ツ	メ	⋮	⋮
3	TC_3(ETX)	DC_3	#	3	C	S	c	s	⋮	⋮	」	ウ	テ	モ	⋮	⋮
4	TC_4(EOT)	DC_4	$	4	D	T	d	t	⋮	⋮	、	エ	ト	ヤ	⋮	⋮
5	TC_5(ENQ)	TC_8(NAK)	%	5	E	U	e	u	Nor yet decided	Nor yet decided	・	オ	ナ	ユ	Undecided	Undecided
6	TC_6(ACK)	TC_9(SYN)	&	6	F	V	f	v	⋮	⋮	ヲ	カ	ニ	ヨ	⋮	⋮
7	BEL	TC_{10}(ETB)	'	7	G	W	g	w	⋮	⋮	ァ	キ	ヌ	ラ	⋮	⋮
8	FE_0(BS)	CAN	(	8	H	X	h	x	⋮	⋮	ィ	ク	ネ	リ	⋮	⋮
9	FE_1(HT)	EM	)	9	I	Y	i	y	⋮	⋮	ゥ	ケ	ノ	ル	⋮	⋮
10	FE_2(LF)	SUB	*	:	J	Z	j	z	⋮	⋮	ェ	コ	ハ	レ	⋮	⋮
11	FE_3(VT)	ESC	+	;	K	[	k	{	⋮	⋮	ォ	サ	ヒ	ロ	⋮	⋮
12	FE_4(FF)	IS_4(FS)	,	<	L	¥	l	|	⋮	⋮	ャ	シ	フ	ワ	⋮	⋮
13	FE_5(CR)	IS_3(GS)	−	=	M	]	m	}	⋮	⋮	ュ	ス	ヘ	ン	⋮	⋮
14	SO	IS_2(RS)	.	>	N	↑	n	¯	⋮	⋮	ョ	セ	ホ	゛	⋮	⋮
15	SI	IS_1(US)	/	?	O	←	o	DEL	↓	↓	ッ	ソ	マ	°	↓	↓

Note: The characters within bold lines are permissable.

Note ↑

TERM

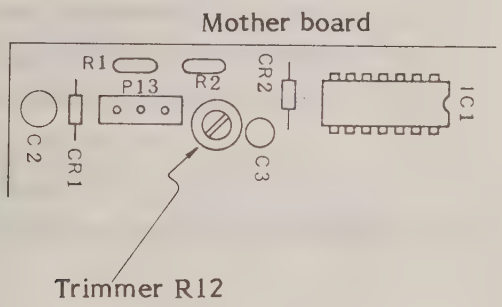
LF, CR

3. Adjustments

3.1 Adjustment of printer

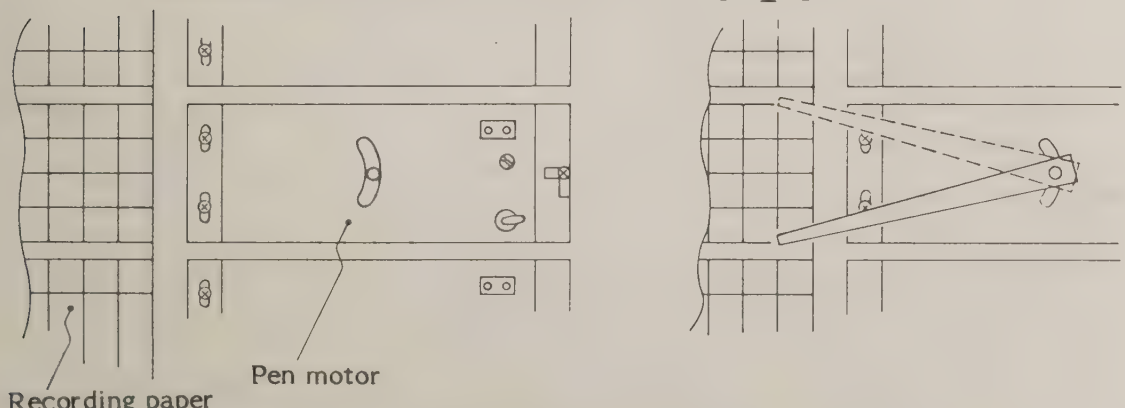
o Standard voltage output V REF (1 V ±0.2%)

1) Remove the panel of the event marker unit of the printer.
2) Turn the trimmer R 12 on the motor board and adjust the voltage between the + and - V REF terminals so that it falls within 1 V ±0.2%.
   The resistance of the V REF output is about 200Ω.



3.2 Mounting of pen motor and alignment of heat pen

1) Adjust the motor of the printer by the 3 screws so that the base line of the recording paper and the side of the pen motor are parallel.
2) Loosely attach the pen to the pen motor axis by the setting screw.
3) Move the pen right and left by hand to check its alignment with the scale marks of the recording paper. If it isn't at right angles to the recording paper, loosen the setting screw and readjust the pen position. Confirm the valid stroke range at the same time. The pen tip pressure in both the S and W models is 20 gr. ±3 gr.



Mounting of pen motor

3.3 Adjustment of stabilizer (±15 V, ±0.2%)

1) Remove the rear panel of the recorder.

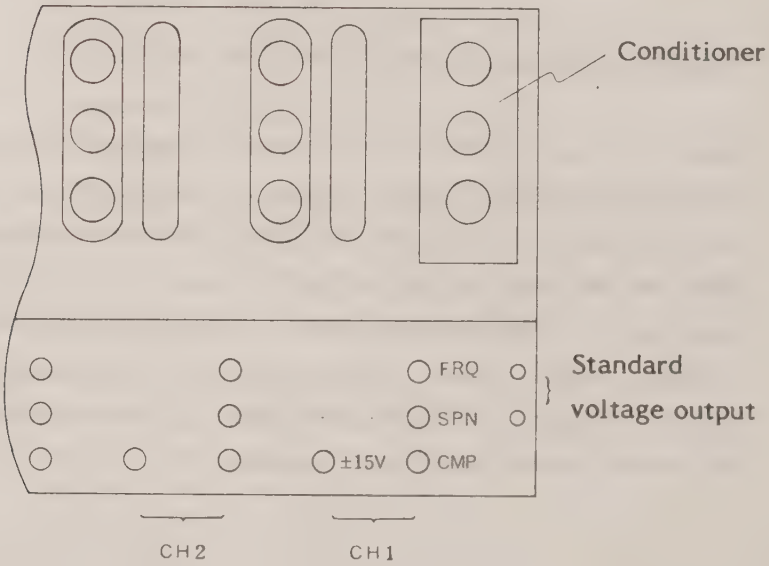
2) Using a flat-blade screw-driver, adjust through the adjusting hole (indicated by "±15 V") on the lower side of the rear panel.

- o The circuit number of the trimmer on the stabilizer board is R6.
- o -15 V falls automatically within the range of ±0.2% by adjusting +15 V.
- o The ±15 V measuring point is at the terminal of connector J8 for the preamplifier. So the preamplifier of the channel being adjusted should be detached.

  +15 V ⟶ B6 pin of J8

  -15 V ⟶ B5 pin of J8

Referring to the negative input terminal (OV)



3.4 Adjustment of servo amplifier

There are 4 terminals for adjusting the servo system. One of them is located on the heat control board of the pen motor unit and zeros the bias voltage applied to the potentiometer.

Set all the trimmers around the center

Amplifier input becomes Ø V when HEAT SW is off.

Make the input Ø (Turn HEAT SW: OFF)

The HEAT SW is located on the panel of the pen motor unit.

1) Adjustment of loop gain

Adjust trimmer R9 (COMP) so that TB2 becomes Ø V.

Pay attention to the balance of the servo system, make sure that all are within ±0.2 V.

2) Zero adjustment

Set the pen at the base line of the recording paper's scale marks by trimmer R20 (ZERO)

Trimmer R20 is mounted on the heat control board. (Detach preamplifier for adjustment.)

3) Adjustment of sensitivity

Apply ±2.5 V and adjust trimmer R4 (SPAN) so that the deviation of pen tip is FS.

Single

Apply 10 mm p-p 1 Hz sine wave.

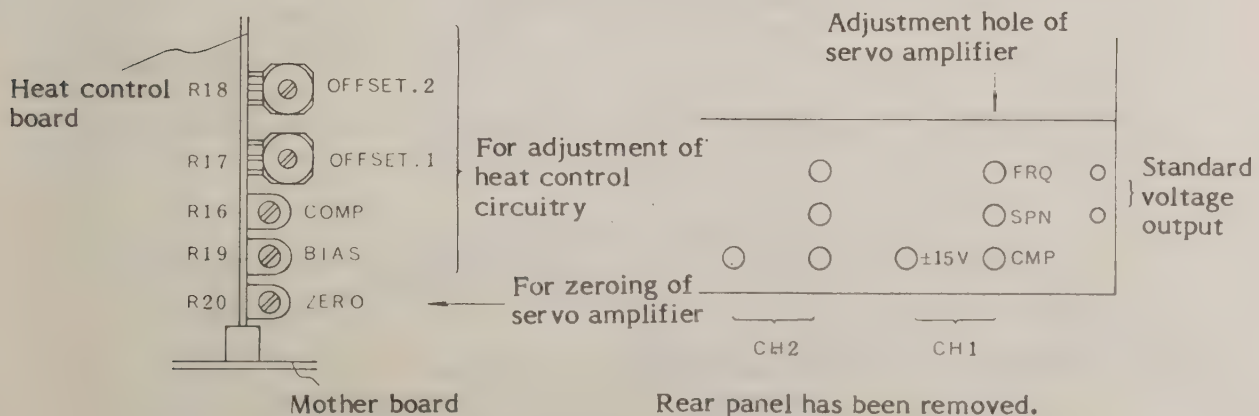
Double

Apply 20 mm p-p 1 Hz sine wave.

4) Adjustment of f characteristics

Adjust trimmer R15 (FREQ) so that amplitude is 10 mm p-p when f = 120 Hz.

Adjust trimmer R5 (FREQ) so that amplitude is 19 mm p-p when f = 60 Hz.



3.5 Adjustment of heat control circuitry (applicable to both S and W models)

- o Electric potentials should be all based on TB1 (GND).
- o During the adjustment, replace the heat pen with a 110 Ω (2W) resistor.

1) Offset adjustment
- o Turn HEAT SW (PMTR SW) OFF
- o Reduce paper feeding speed signal VCHRT to Ø V (STOP SW, ON)

OFFSET 1: Adjust trimmer R17 so that TB2 is Ø V.

OFFSET 2: Adjust trimmer R18 so that TB3 is Ø V.

2) Gain adjustment
Bias adjustment
COMP

o Turn HEAT SW = ON

Adjust trimmer R16 so that TB2 is approximately 250 mV when pen is twisted by a triangular wave of 1.25 Hz, 40 mm p-p.

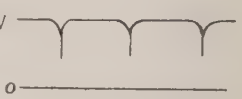
Wave form of TB2 +250 mV

Short-circuit TB4 and TB1 (GND)

V_0: voltage between positive terminal of 110 Ω resistor and GND.

Adjust heat control volume so that V_0 is approximately 4.2 V when pen is twisted by a triangular wave of 1.25 Hz, 40 mm p-p.

Wave form of V_0 +4.2 V



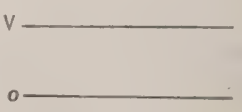
Disconnect the short-circuit between TB4 and TB1 stop the pen.

EXT. SW and HEAT. SW } ON

BIAS

Adjust trimmer R19 so that V_0 is approximately 3.8.

V_0 wave form +3.8 V



3) Check of limiter

Twist pen by inputting a triangular wave of 10 Hz, 40 mm p-p (approx.).

$V_0 \fallingdotseq 8$ V when feed is less than 19 mm/s
$V_0 \fallingdotseq 13$ V when feed is more than 19 mm/s

4) Recording

Replace the 110 Ω resistor with the heat pen and make a test print. Adjust heat control potentiometer.

3.6 Adjustment of preamplifier

1) Balance adjustment (L amplifier doesn't have a BAL2 trimmer.)

Set all the trimmers around the center.

↓

Turn input switch off Set MULTIPLY to mV.

↓

BAL 1 — Adjust trimmer R12 (BAL1) so that pen position at max. sensitivity coincides with that at min. sensitivity.

↓

Turn input switch to MEAS (Input open)

↓

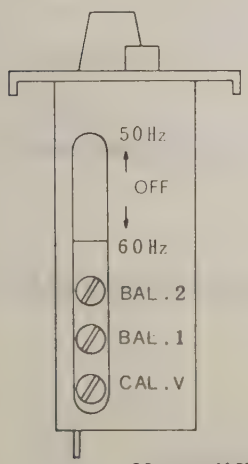
BAL2 — Adjust trimmer R6 (BAL2) so that pen position when at MEAS coincides with that when at off.

2) Gain adjustment

Single	Double
Set the range to 500 mV/cm, and the pen at the center (base line).	Set the range to 250 mV/cm, and the pen at the center (base line).
GAIN (panel) — Adjust the gain potentiometer so that pen can be moved by 20 mm when 1 V is applied.	Adjust the gain potentiometer so that pen can be moved by 40 mm when 1 V is applied.

3) Calibration voltage adjustment

Single	Double
CAL.V — Adjust trimmer R24 (CAL.V) so that pen can be moved by 20 mm when pen is set to the center (base line) and input switch is turned to CAL.V.	Adjust trimmer R24 (CAL.V) so that pen can be moved by 40 mm when pen set at the center (base line) and input switch is turned to CAL.V.



H amplifier trimmer adjustment panel

Note 1) BAL1 is adjusted if the pen tip moves (0.3 mm or more) when the range potentiometer is turned.

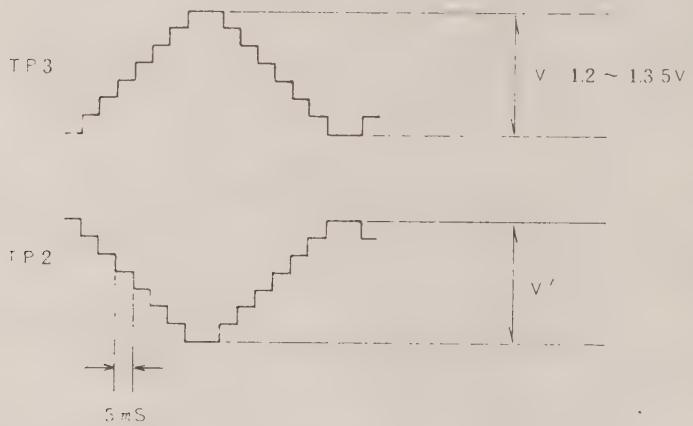
Note 2) BAL2 is adjusted if the pen tip moves (0.3 mm or more) when MULTIPLY SW is turned.

3.7 Adjustment of paper feeding circuitry

(All channels of pen motor's HEAT SW, should be turned off. Marker's connector should be pulled out.)

During the following adjustment, the connectors J1 (DC motor, etc.) and J4 (pulse motor) should be disconnected from the printer.

1) PR 3101-02 (controller) TP2, TP3 readjustment (based on TP1 (GND))
This should be done at a feeding speed of 5 mm/sec.

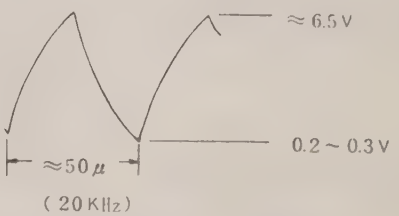


VR1 is adjusted so that V' coincides with V.

2) PR3101-13 (driver) TP1, TP2, TP3 readjustment (based on GND)

TP1 Adjust by VR2 so that it is Ø V when STOP SW is on.

TP2 Set the LOW LEVEL to 0.2 - 0.3 V by VR1.

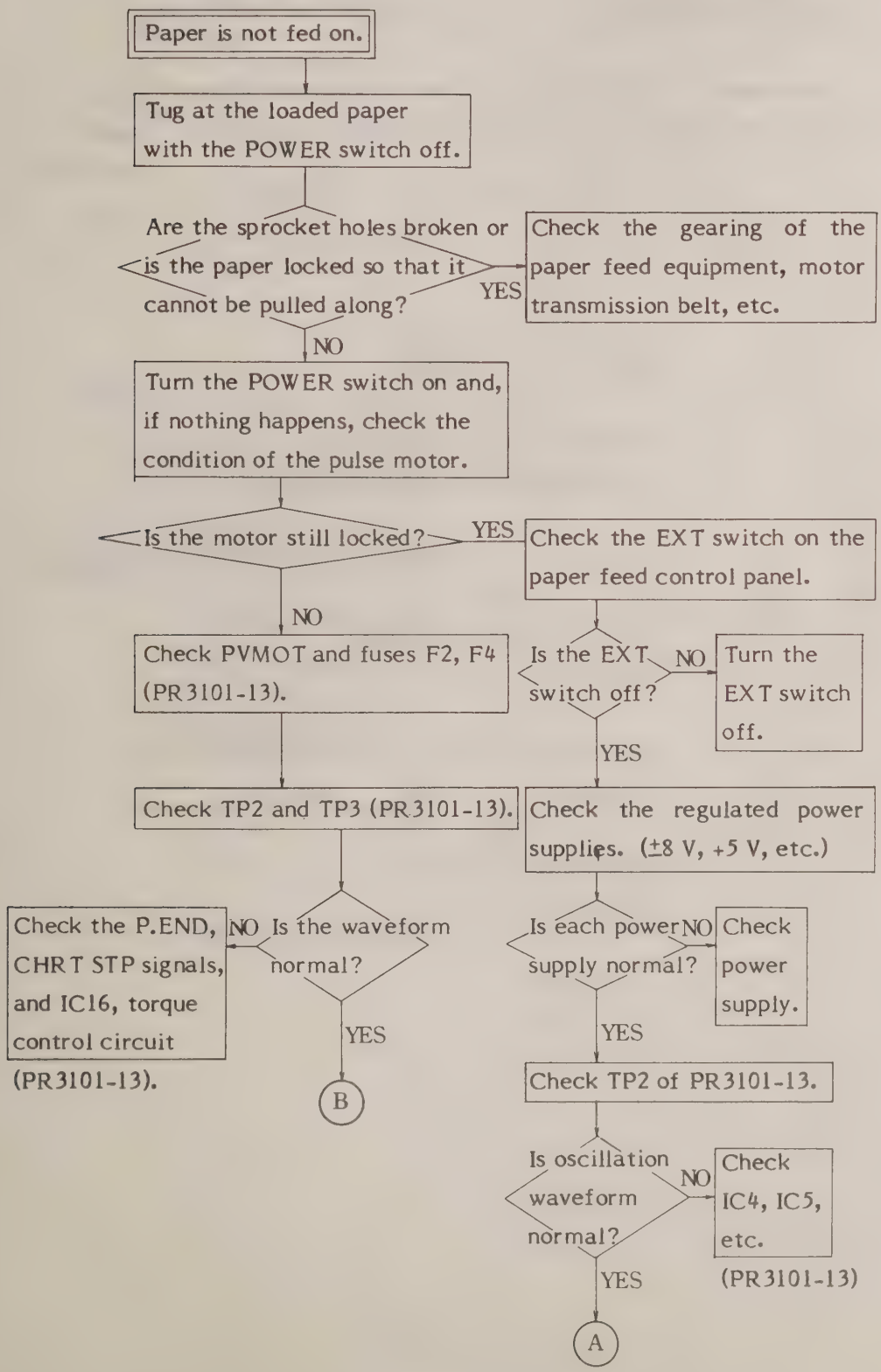


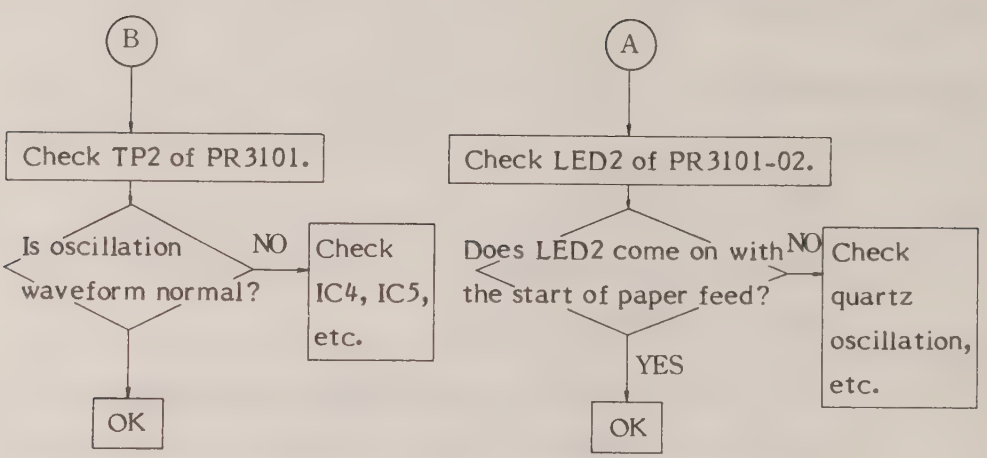
TP3 Adjust by VR3 so that TP3 is 8 V at a feeding speed of 10 mm/sec.

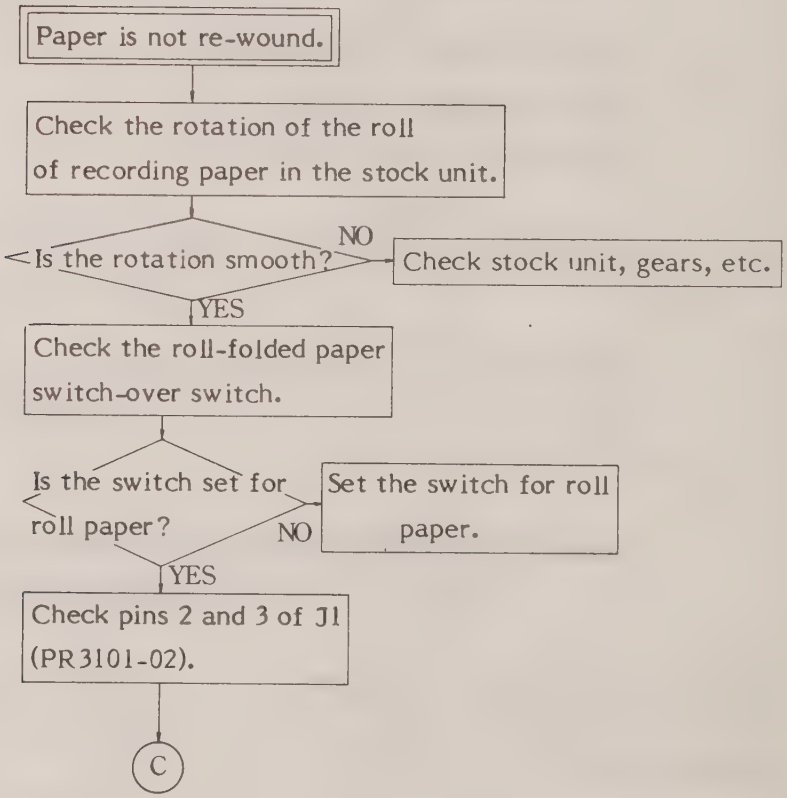
After all the above is completed, turn POWER SW off and connect all the connecters.

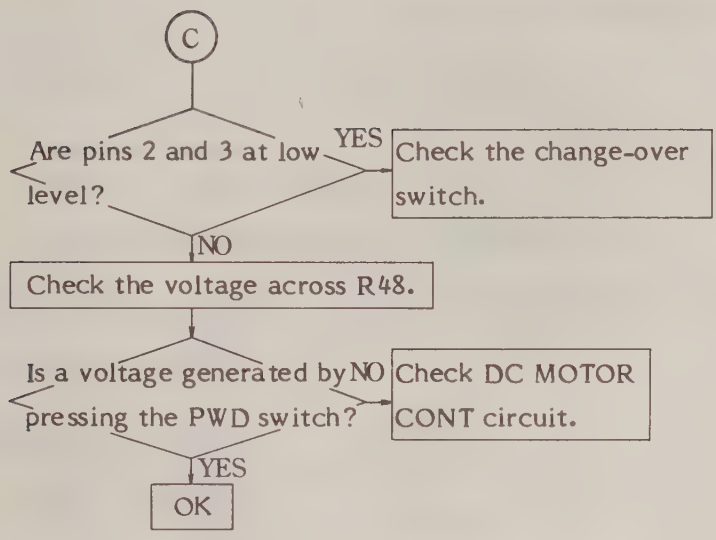
4. TROUBLESHOOTING

4-1 Paper feed

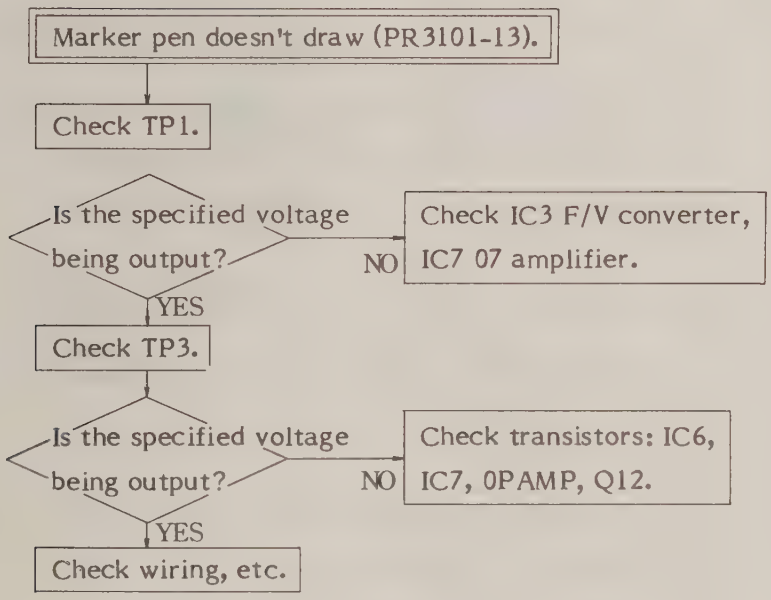

Paper is not fed on.
Tug at the loaded paper with the POWER switch off.
Are the sprocket holes broken or is the paper locked so that it cannot be pulled along?
YES
Check the gearing of the paper feed equipment, motor transmission belt, etc.
NO
Turn the POWER switch on and, if nothing happens, check the condition of the pulse motor.
Is the motor still locked?
YES
Check the EXT switch on the paper feed control panel.
NO
Check PVMOT and fuses F2, F4 (PR3101-13).
Is the EXT switch off?
NO
Turn the EXT switch off.
YES
Check TP2 and TP3 (PR3101-13).
Check the regulated power supplies. (±8 V, +5 V, etc.)
Check the P.END, CHRT STP signals, and IC16, torque control circuit (PR3101-13).
NO
Is the waveform normal?
YES
B
Is each power supply normal?
NO
Check power supply.
YES
Check TP2 of PR3101-13.
Is oscillation waveform normal?
NO
Check IC4, IC5, etc. (PR3101-13)
YES
A


B
Check TP2 of PR3101.
Is oscillation waveform normal?
NO
Check IC4, IC5, etc.
OK
A
Check LED2 of PR3101-02.
Does LED2 come on with the start of paper feed?
NO
Check quartz oscillation, etc.
YES
OK

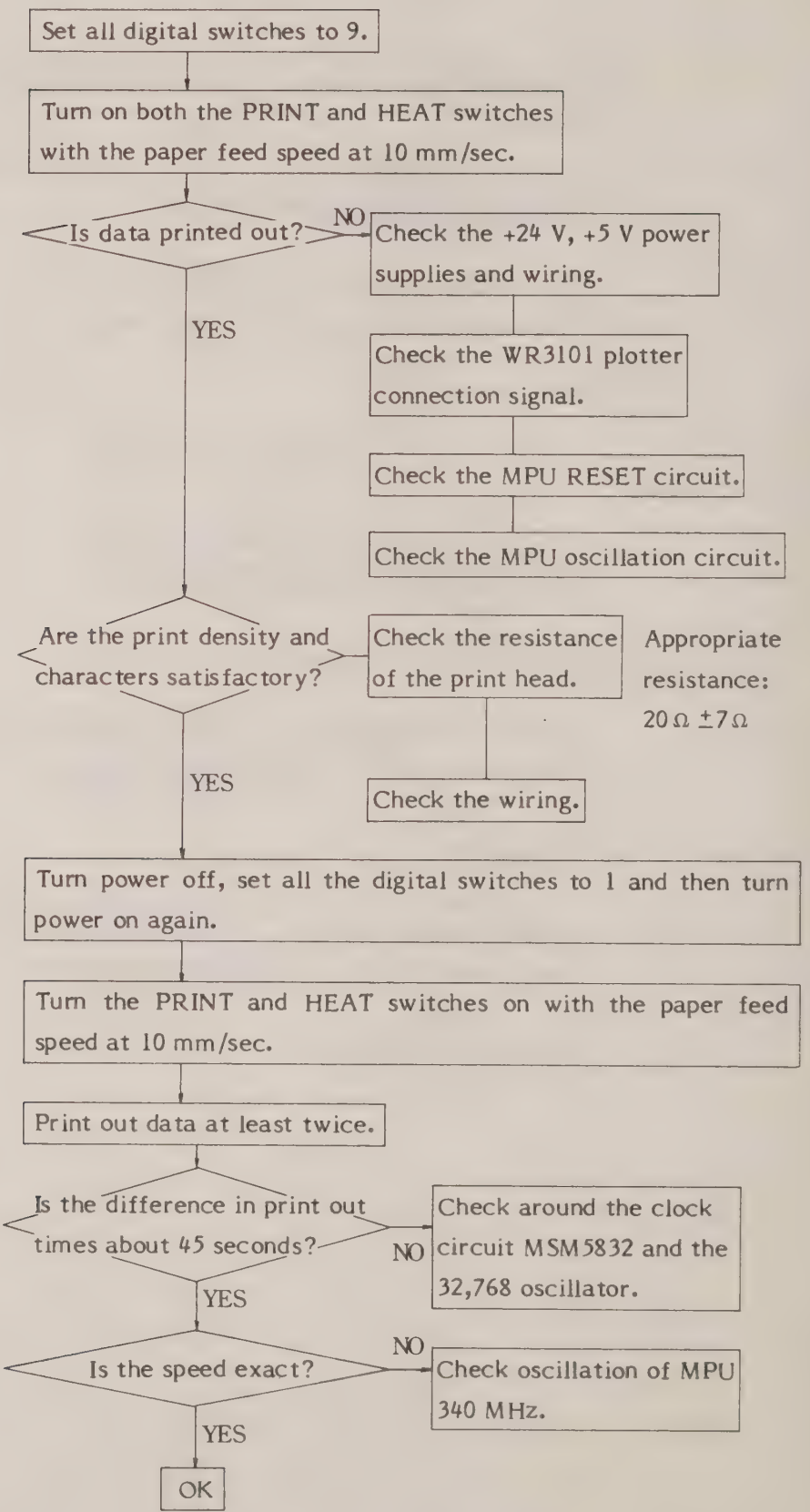

Paper is not re-wound.
Check the rotation of the roll of recording paper in the stock unit.
Is the rotation smooth?
NO
Check stock unit, gears, etc.
YES
Check the roll-folded paper switch-over switch.
Is the switch set for roll paper?
NO
Set the switch for roll paper.
YES
Check pins 2 and 3 of J1 (PR3101-02).
C

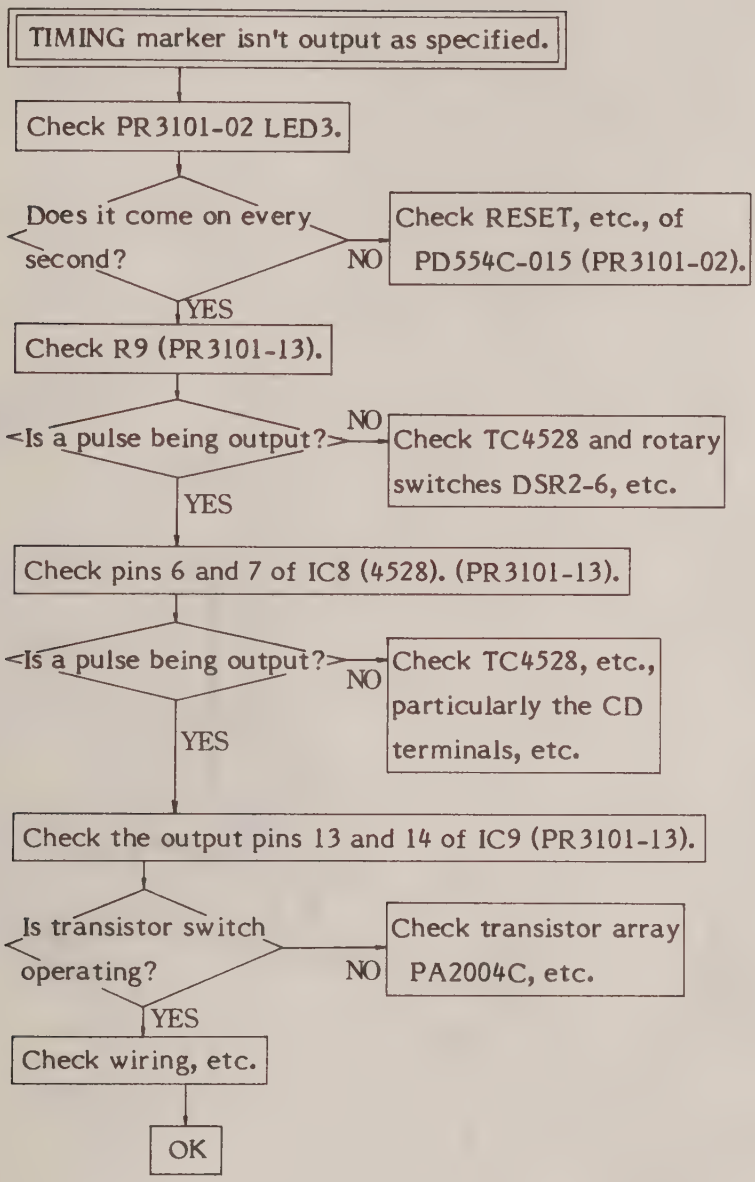

C
Are pins 2 and 3 at low level?
YES
Check the change-over switch.
NO
Check the voltage across R48.
Is a voltage generated by pressing the PWD switch?
NO
Check DC MOTOR CONT circuit.
YES
OK

4-2 Marker

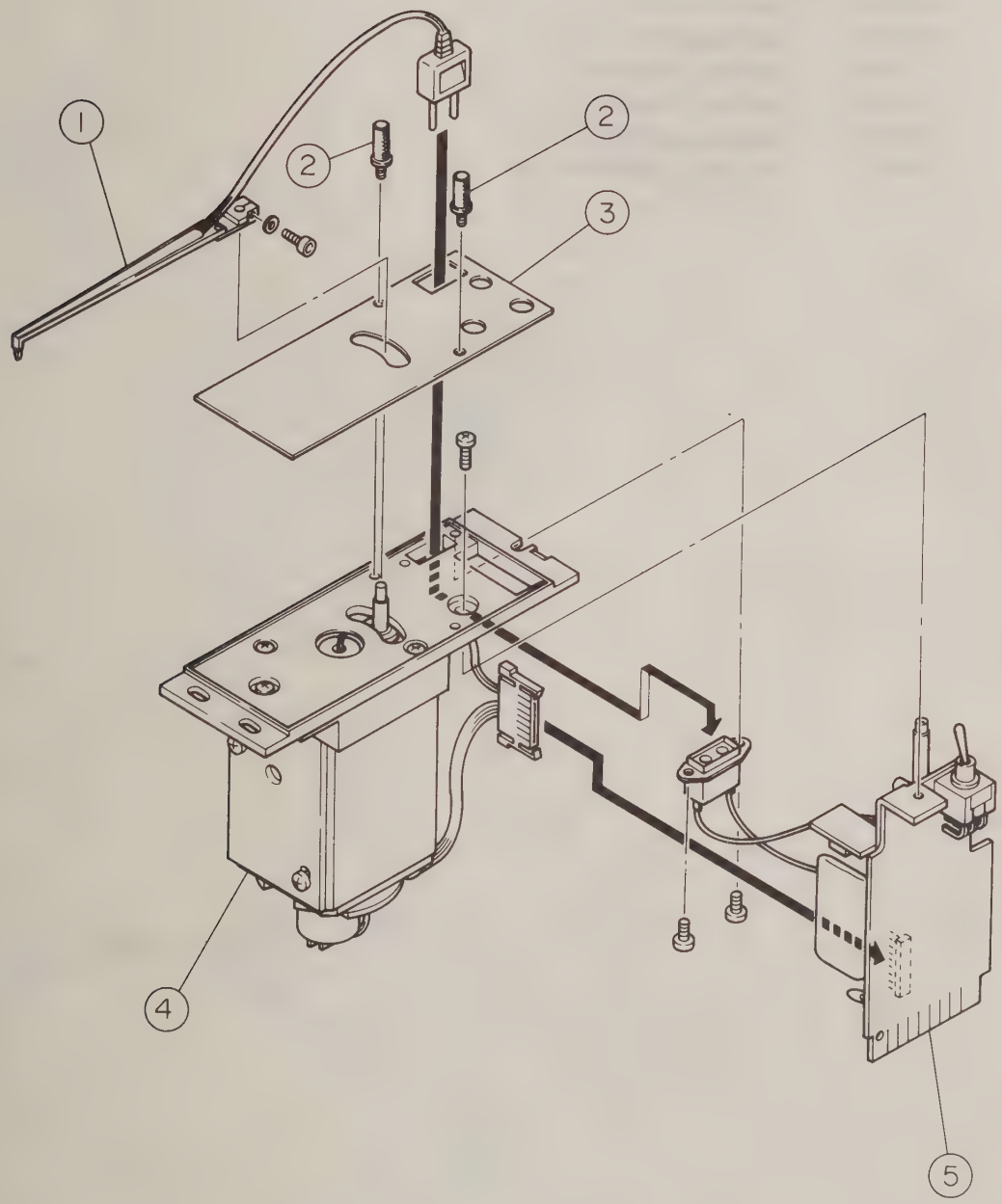

Marker pen doesn't draw (PR3101-13).
Check TP1.
Is the specified voltage being output?
NO
Check IC3 F/V converter, IC7 07 amplifier.
YES
Check TP3.
Is the specified voltage being output?
NO
Check transistors: IC6, IC7, 0PAMP, Q12.
YES
Check wiring, etc.

4-3 Printer (internal mode)


Set all digital switches to 9.
Turn on both the PRINT and HEAT switches with the paper feed speed at 10 mm/sec.
Is data printed out?
NO
Check the +24 V, +5 V power supplies and wiring.
YES
Check the WR3101 plotter connection signal.
Check the MPU RESET circuit.
Check the MPU oscillation circuit.
Are the print density and characters satisfactory?
Check the resistance of the print head.
Appropriate resistance: 20Ω ±7Ω
YES
Check the wiring.
Turn power off, set all the digital switches to 1 and then turn power on again.
Turn the PRINT and HEAT switches on with the paper feed speed at 10 mm/sec.
Print out data at least twice.
Is the difference in print out times about 45 seconds?
NO
Check around the clock circuit MSM5832 and the 32,768 oscillator.
YES
Is the speed exact?
NO
Check oscillation of MPU 340 MHz.
YES
OK


TIMING marker isn't output as specified.
Check PR3101-02 LED3.
Does it come on every second?
NO
Check RESET, etc., of PD554C-015 (PR3101-02).
YES
Check R9 (PR3101-13).
Is a pulse being output?
NO
Check TC4528 and rotary switches DSR2-6, etc.
YES
Check pins 6 and 7 of IC8 (4528). (PR3101-13).
Is a pulse being output?
NO
Check TC4528, etc., particularly the CD terminals, etc.
YES
Check the output pins 13 and 14 of IC9 (PR3101-13).
Is transistor switch operating?
NO
Check transistor array PA2004C, etc.
YES
Check wiring, etc.
OK

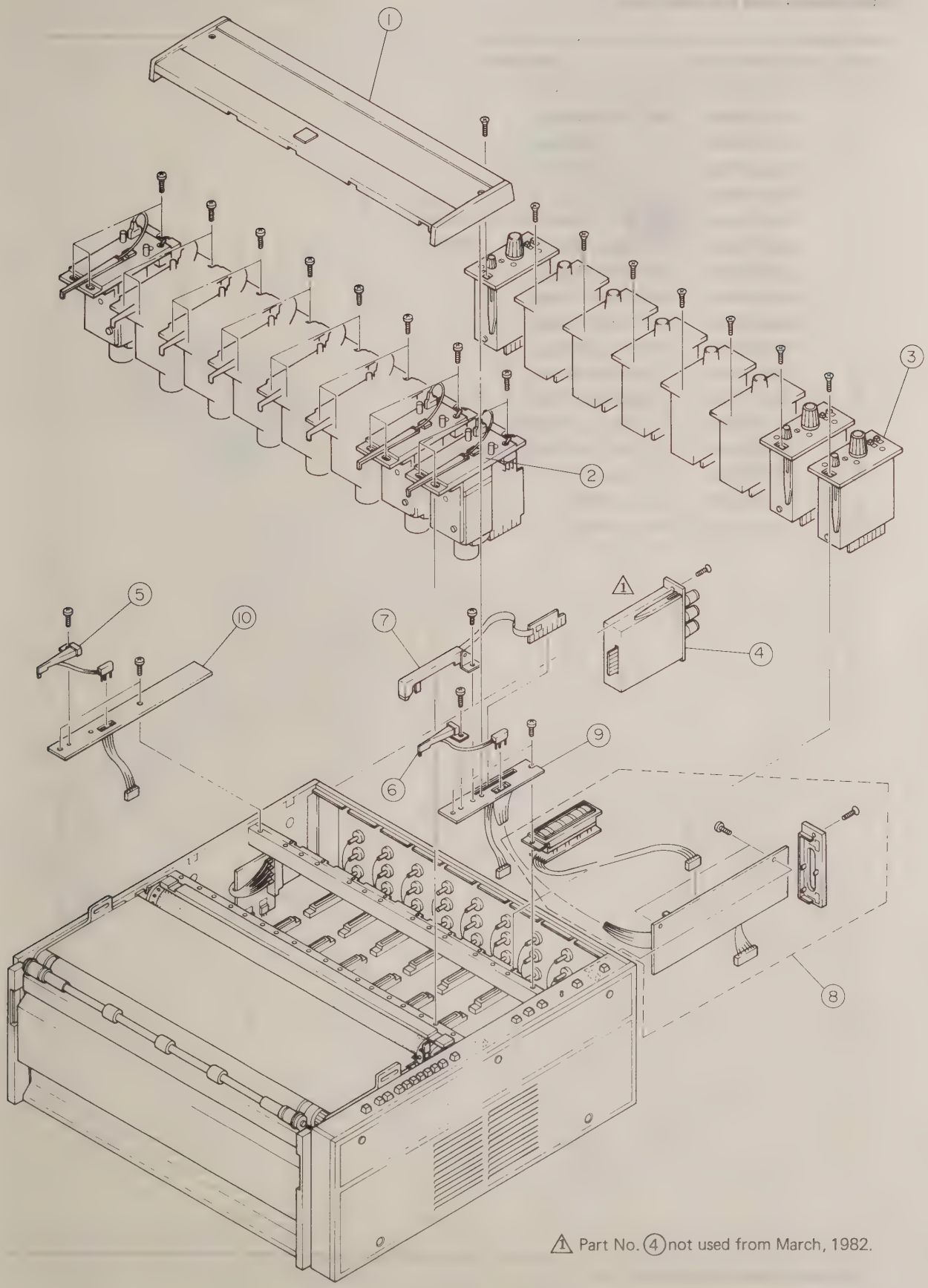
Pen Motor Mechanism



Pen Motor Mechanism

Item	Part & Block No.	Desctiption		Remarks
1	772310114	Pen, KT-201 (40mmP-P)		
	772310124	Pen, KT-202 (80mmP-P)		
2	031013700	Knob		
3	031013510	Panel (40mmP-P)		
	031013550	Panel (80mmP-P)		
4	772310115	Pen Motor (40mm P-P)		
	772310121	Pen Motor (80mmP-P)		
5	772310113	Heat-Control (40mmP-P) unit		
	772310123	Heat-Control (80mmP-P) unit		

Pen Control And Pre Amp Unit



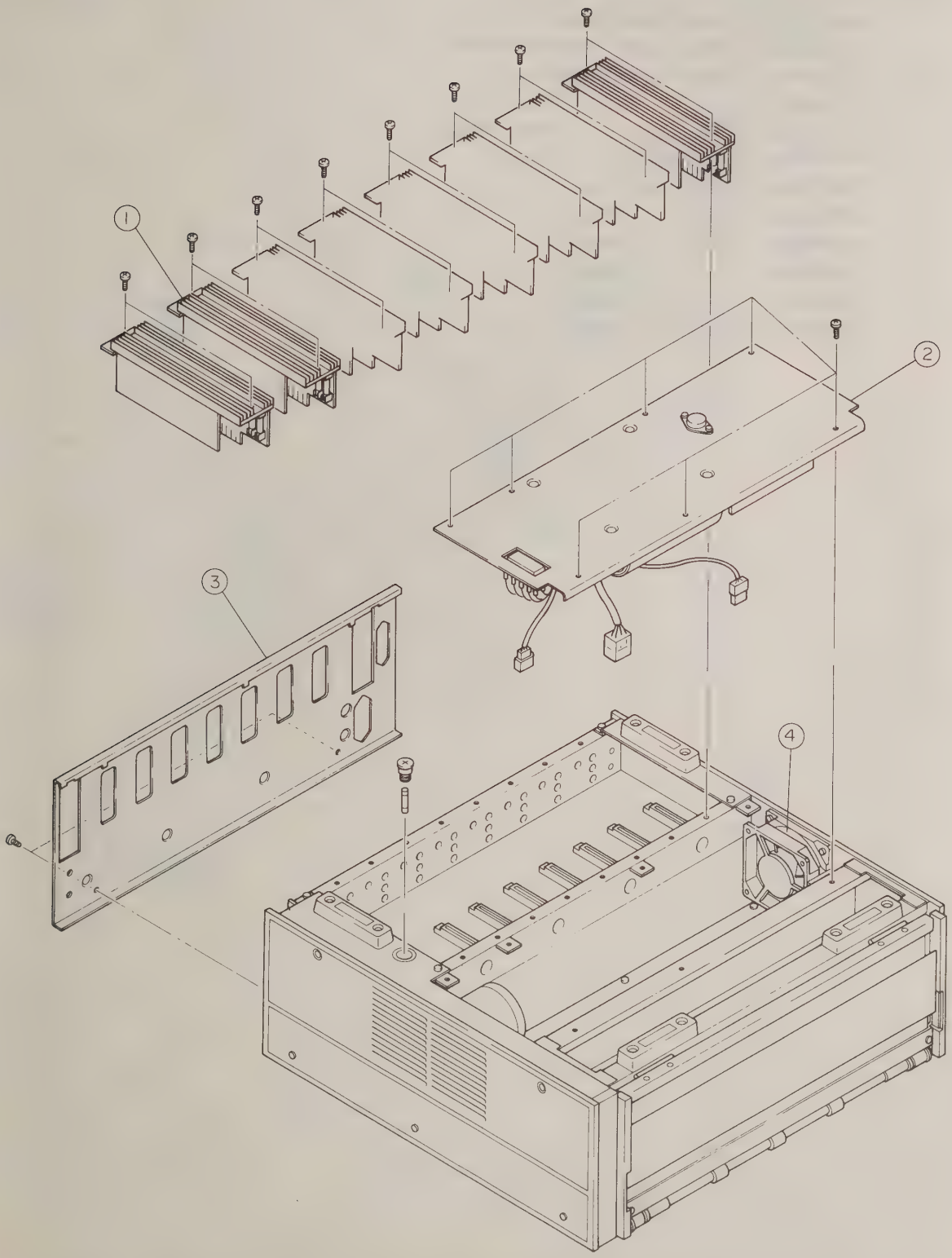
⚠1 Part No. (4) not used from March, 1982.

Pen Control And Pre Amp Unit

Item	Part & Block No.	Description		Remarks
1	031015340	Pen Cover (2 Pen)		
	031015530	Pen Cover (4 Pen)		
	031015630	" (6 Pen)		
	031015730	" (8 Pen)		
	031015830	" (12 Pen)		
2	802310110	Pen Motor (40mm P-P)	GS3101	
	802310120	Pen Motor (80mm P-P)	GW3101	
3	804310130	AL3101 (L Type)		
	804310140	AH3101 (H Type)		
	804310150	AL3102 (DL Type)		
	804310160	AH3102 (DH Type)		
* 4	774310110	Conditioner Box		
5	731014320	KT-203 (Pen Marker)		
6	731014320	KT-209 (Pen Timing)		
7	771310185	KT-208, Print-Head (Thermal)		
8	771310186	Print Control		
9	031015180	Timing Panel		
10	031015300	Marker Panel		

* This part not used from March, 1982.

Bottom Side Assembly



Bottom Side Assembly

Item	Part & Block No.	Description		Remarks
1	804310113	Main Amplifier (Ampl 40mmP-P)		
	804310122	Main Amplifier (Ampl 90mmP-P)		
2	771310166	Power Circuit Block (2 Pen)		
	771310167	" (4 Pen)		
	771310168	" (6 Pen, 8 Pen)		
	771310170	" (12 Pen)		
3	031015350	Back Cover (2 Pen)		
	031015540	" (4 Pen)		
	031015640	" (6 Pen)		
	031015741	" (8 Pen)		
	031015841	" (12 Pen)		
4	509600004	Fan Motor PXJ43B1		

Chart Drive Mechanism and Control Unit

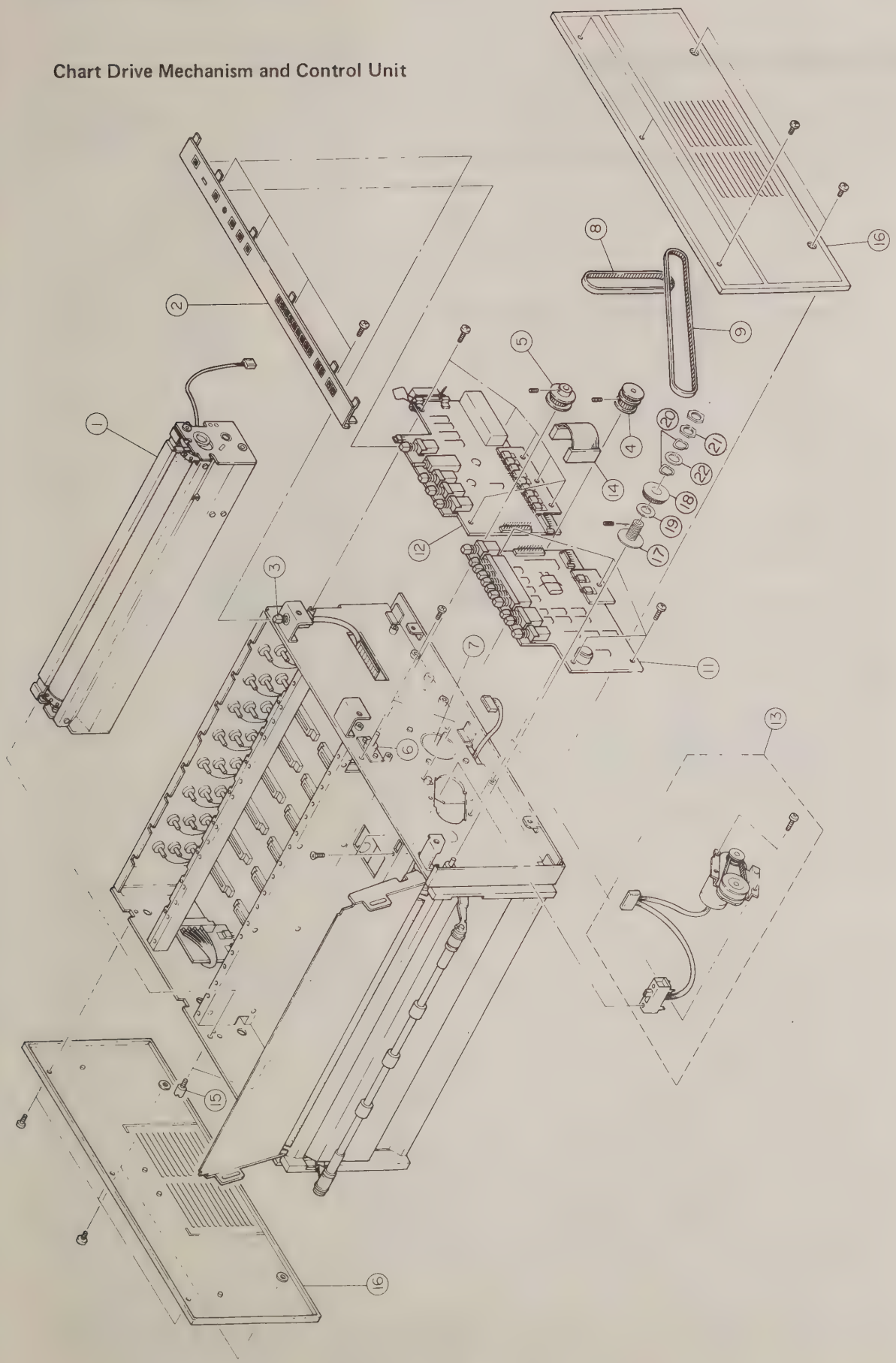
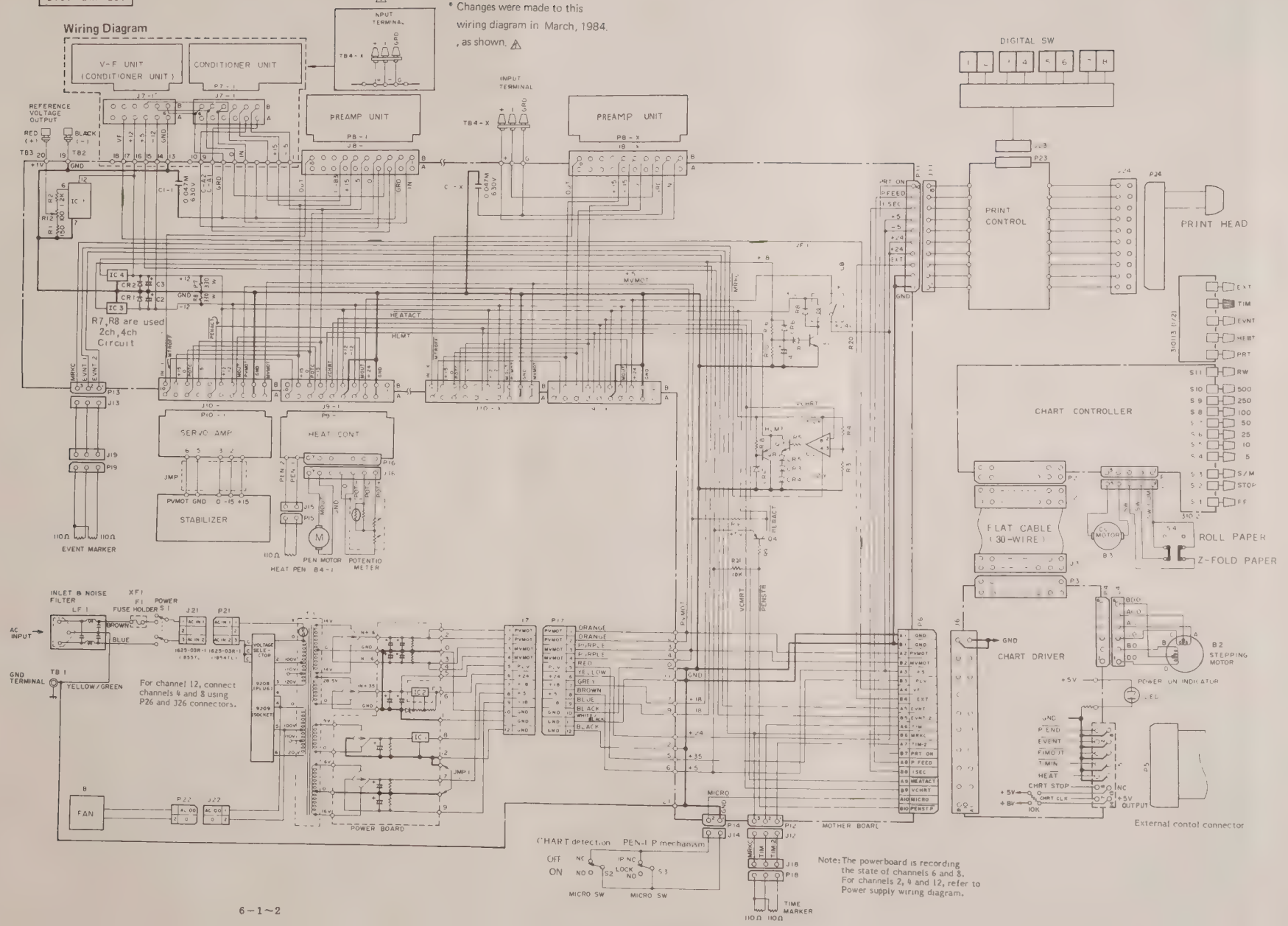


Chart Drive Mechanism and Control Unit

Item	Part & Block No.	Description		Remarks
1	771310123	Chart Drive Mechanism Block (2 Pen)		
	771310124	" (4 Pen)		
	771310125	" (6 Pen)		
	771310126	" (8 Pen)		
	771310127	" (12 Pen)		
2	031015130	Control Panel		
3	508101010	Switch Power, 1P-0008AC1920		
4	731016010	Gear-A		
5	731016050	Gear-B		
6	031016080	Drive Shaft		
7	509410001	Stepping Motor KP6R2-011		
8	373101020	Synchro Belt 112MXL6.4		
9	373101010	Synchro Belt 224MXL3.2		
11	771310177	Chart Control Unit PR31012		
12	771310176	Chart Driver Unit PR310113		
13		Rewind Mechanism		
14	520110060	Flat Cable with Connector L42-30P		
15	031012100	Screw, Chart Drive Block		
16	031015020	Side Cover		
17	731014640	Shaft		
18	031014670	Pulley		
19	031014680	Slip Plate		
20	306500230	Washer, WW10		
21	306500220	Nut, M10PI		
22	031014690	Plate		

Wiring Diagram

* Changes were made to this wiring diagram in March, 1984. ⚠ as shown. ⚠



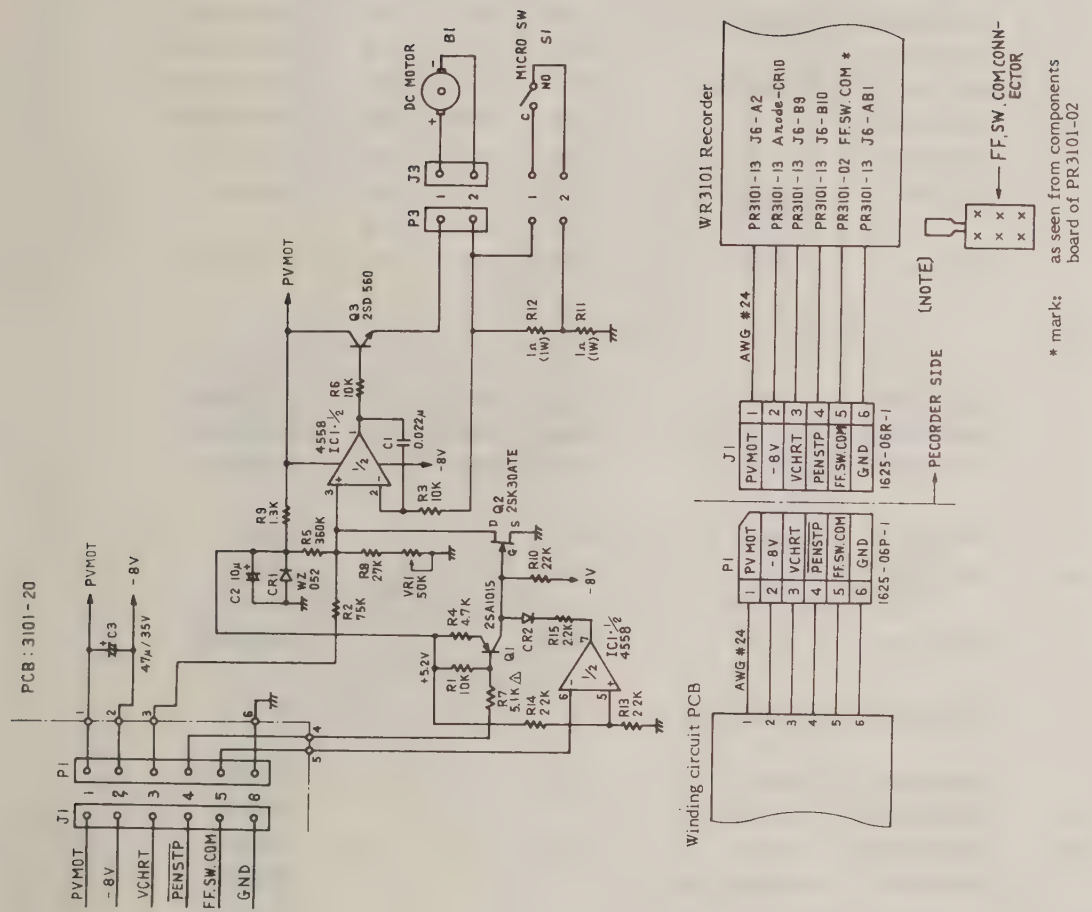
Wiring Diagram

Figure	Part No.	Description			Type	Remarks
W1	520100017	AC Cord			DC011-001	
LF1	518110004	Line Filter	6A		610G6	
XF1	512400002	Fuse Holder			SN-2056	
S1	508101010	Switch, Push	AC250V, 4A		1P-0008AC1920	
S2	508401004	" Micro			CC-5-R	
S3	508401010	" Micro			SS-5GL	
S4	508302005	" Slide			SSB022L6, R, NS	
TB1	514400004	Terminal			SQ0204-02	
TB2	514400005	"	Red		PTJ470A2	
TB3	514400006	"	Black		PTJ470A0	
TB4-X	514400010	Input Terminal	3P	Red	W—R	x 2 x CH
	514400011	Input Terminal	3P	Black	W—B	x CH
J1	513400044	Connector, Receptacle	5P		HNC2-2.5S-5	
CNP	513400037	Contact Pin			HNC-2.5S-A	x 5, For J1
J4	513400036	Connector, Receptacle	4P		HNC2-2.5S-6	
CNP	513400037	Contact Pin			HNC-2.5S-A	x 6, For J4
P5	513100321	Connector, Plug	14P		57-30140	For EXT Cont.
J7	513300609	Connector	6P x 2		225J20621-488	
J12	513400041	Connector, Receptacle	3P		HNC2-2.5S-3	
CNP	513400042	Contact Pin			HNC-2.5S-B	x 3, For J12
J13	513400041	Connector, Receptacle	3P		HNC2-2.5S-3	
CNP	513400042	Contact Pin			HNC-2.5S-B	x 3, For J13
J14	513400043	Connector, Receptacle	2P		HNC2-2.5S-2	
CNP	513400042	Contact Pin			HNC-2.5S0B	x 2, For J14
J18	513200311	Connector, Receptacle	3P		3965-SC	Pair
P18		" , Plug	3P			
J19	513200311	Connector, Receptacle	3P		3965-SC	Pair
P19		" , Plug	3P			
J21	513200302	Connector, Receptacle	3P		1625-3R	
CNP	513400022	Contact Pin			1561TL	x 2, For J21
P22	513200202	Connector, Plug	2P		1625-2P-1	
CNP	513400001	Contact Pin			1854TL	x2, For P22 } For 6CH 8CH 12CH
B1	509600004	Fan Motor	AC100V		PXJ43B1	
B2	509410001	Stepping Motor			KP6R2-011	
B3	509100017	DC Motor, Coreless,	DC24V		LN30-N21N1	
Cap	516100009	Cap,	Red		B101	For S1

Wiring Diagram

Figure	Part No.	Description		Type	Remarks
F1	512300027	Fuse, Time Lag	4A	F102-SGA-4A	For 2CH, 4CH, 6CH (AC100V, 117V)
F1	512300028	Fuse, Time Lag	6A	F102-SGA-6A	For 8CH, 12CH (AC100V, 117V)
F1	512300029	Fuse, Time Lag	2A	F102-SGA-2A	For 2CH, 4CH, 6CH (AC220V, 240V)
F1	512300031	Fuse, Time Lag	3A	F102-SGA-3A	For 8CH, 12CH (AC220V, 240V)
S-Bar	004407010	Short Bar			x CH

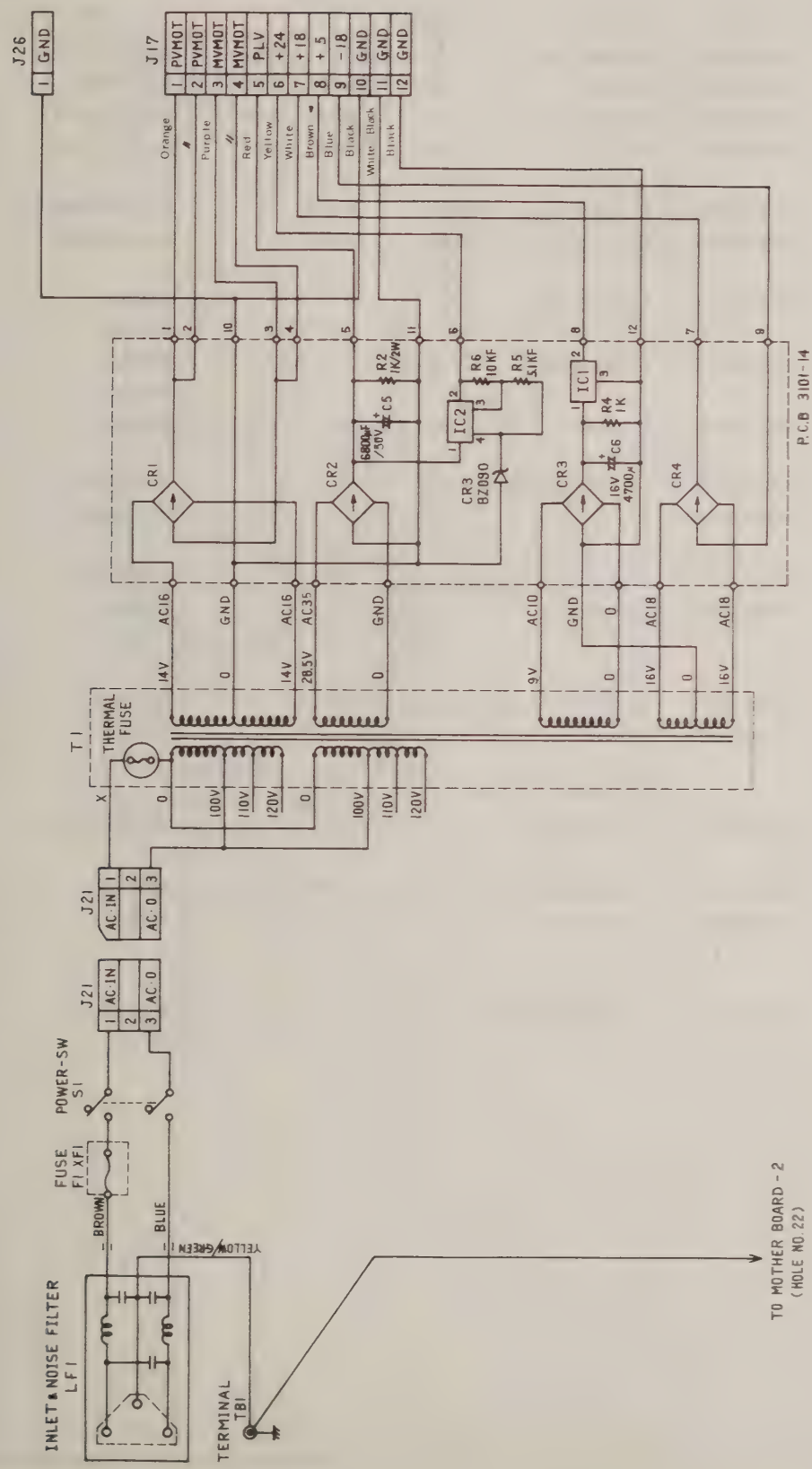
Winding circuit



Winding Circuit

Figure	Part No.	Description				Type	Remarks
R1	G501203725	R, Solid	10K	1/4W	±5%	RC1/4-10KJ	
R2	G501303757	R, Metal Film	75K	1/4W	±5%	RNE1/4-75KJ	
R3	G501203725	R, Solid	10K	1/4W	±5%	RC1/4-10KJ	
R4	G501203722	R, Solid	4.7K	1/4W	±5%	RC1/4-4.7KJ	
R5	J501330104	R, Metal Film	360K	1/4W	±5%	RNE1/4-360KJ	
R6	G501203725	R, Solid	10K	1/4W	±5%	RC1/4-10KJ	
R7	G501810351	R, "	5.1K	"	±1%	RN1/4-5.1KF	
R8	G501303752	R, Metal Film	27K	1/4W	±5%	RNE1/4-27KJ	
R9	G501303751	R, "	1.3K	1/4W	±5%	RNE1/4-22KJ	
R10	J501203727	R, Solid	22K	1/4W	±5%	RC1/4-22KJ	
R11	J501605711	R, Metal Film	1	1W	±5%	RSFIB-1J	
R12	"	R, "	1	1W	±5%	"	
R13	G501203719	R, Solid	2.2K	1/4W	±5%	RC1/4-2.2KJ	
R14	"	R, "	"	"	"	"	
R15	"	R, "	"	"	"	"	
C1	G502303008	C, Myler Film	0.022μ	50WV		MFL-05S22	
C2	G502203002	C, Tantalum	10μ	16WV		CS15EIC100M	
C3	J502103028	C, Electrolytic	47μ	35WV		SM35VB-47	
CR1	A503100060	Di, Zener	V_Z=5.2V			WZ052	
CR2	G503100020	Di, Si	V_R=30V	I_F=100mA		IS953	
IC1	G503300054	IC, Op-Amp	Dual			NJM4558D	
S1	A508401004	Switch, Micro				CC-5-R	
Q1	G503203016	T, PNP	−30V	−100mA	200mW	2SA1015, Y	
Q2	A503200027	T, N-J-FET				2SK30A	
Q3	A503200028	T, NPN	100V	5A	1.5W	2SD560, L	
	B520100012	Insulating Sheet				30B6001	For Q3
VR1	B504207038	R, Trimmer Cermet	50K			TM10KPV50K	
B1	A509100017	DC Motor, Coreless	DC24V			LN30-N21N1	
P1	A513200601	Connector, Plug	6P			1625-06P-1	
CNP	G513400001	Contact Pin				1854-TL	For P1
P3	B513400038	Connector, Pin Header	2P			HNC2-2, 5P2DS	
J1	A513200602	Connector, Receptacle	6P			1625-06R-1	
CNP	G513400002	Contact Pin				1855-TL	For J1
J3	B513400043	Connector, Receptacle	2P			HNC2-2.5S-2	
CNP	B513400037	Contact Pin				HNC-2.5S-A	For J3
PCB	511310200	Printed Circuit Board				3101-20	

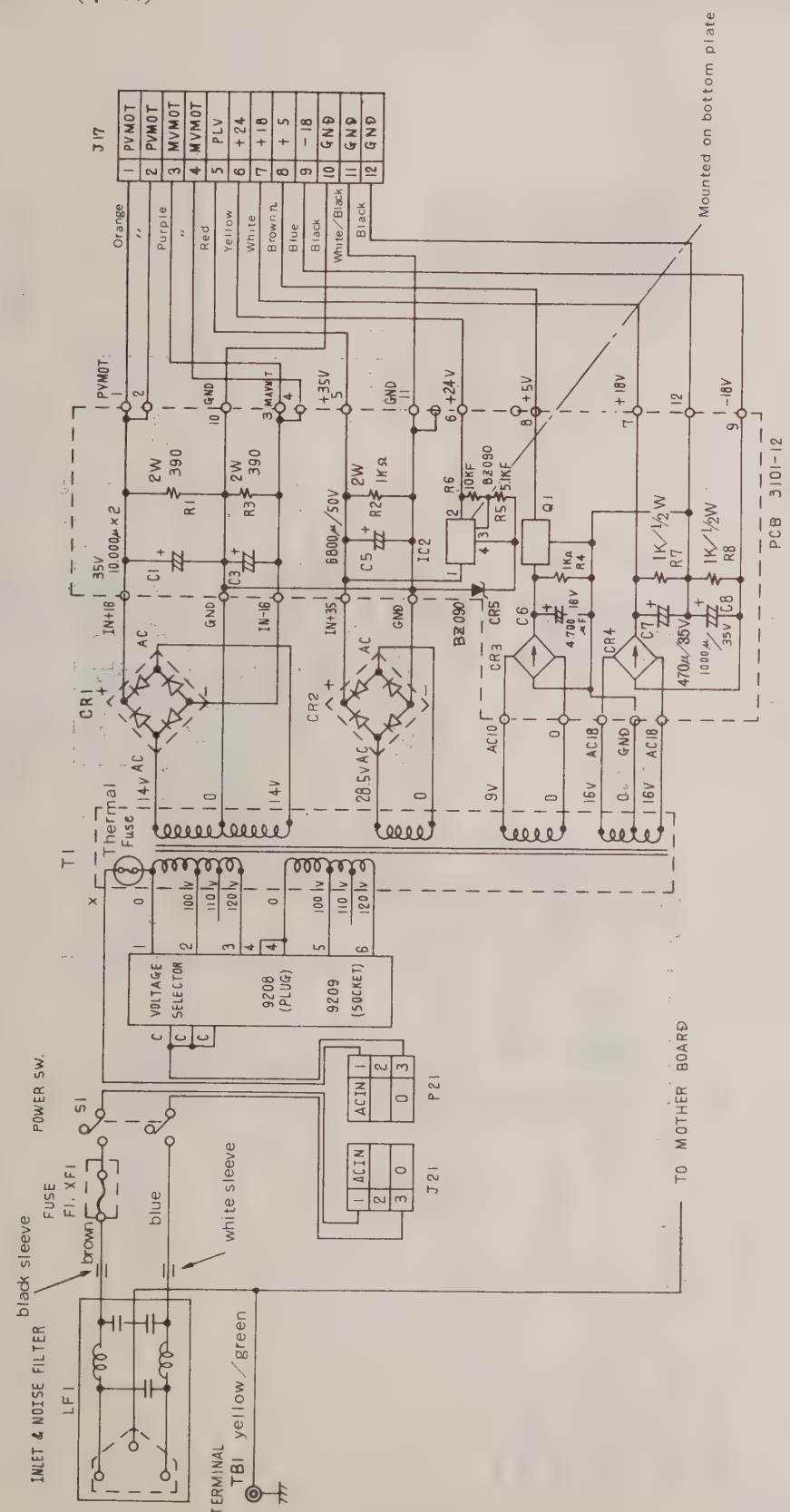
Power Unit (2 CH)



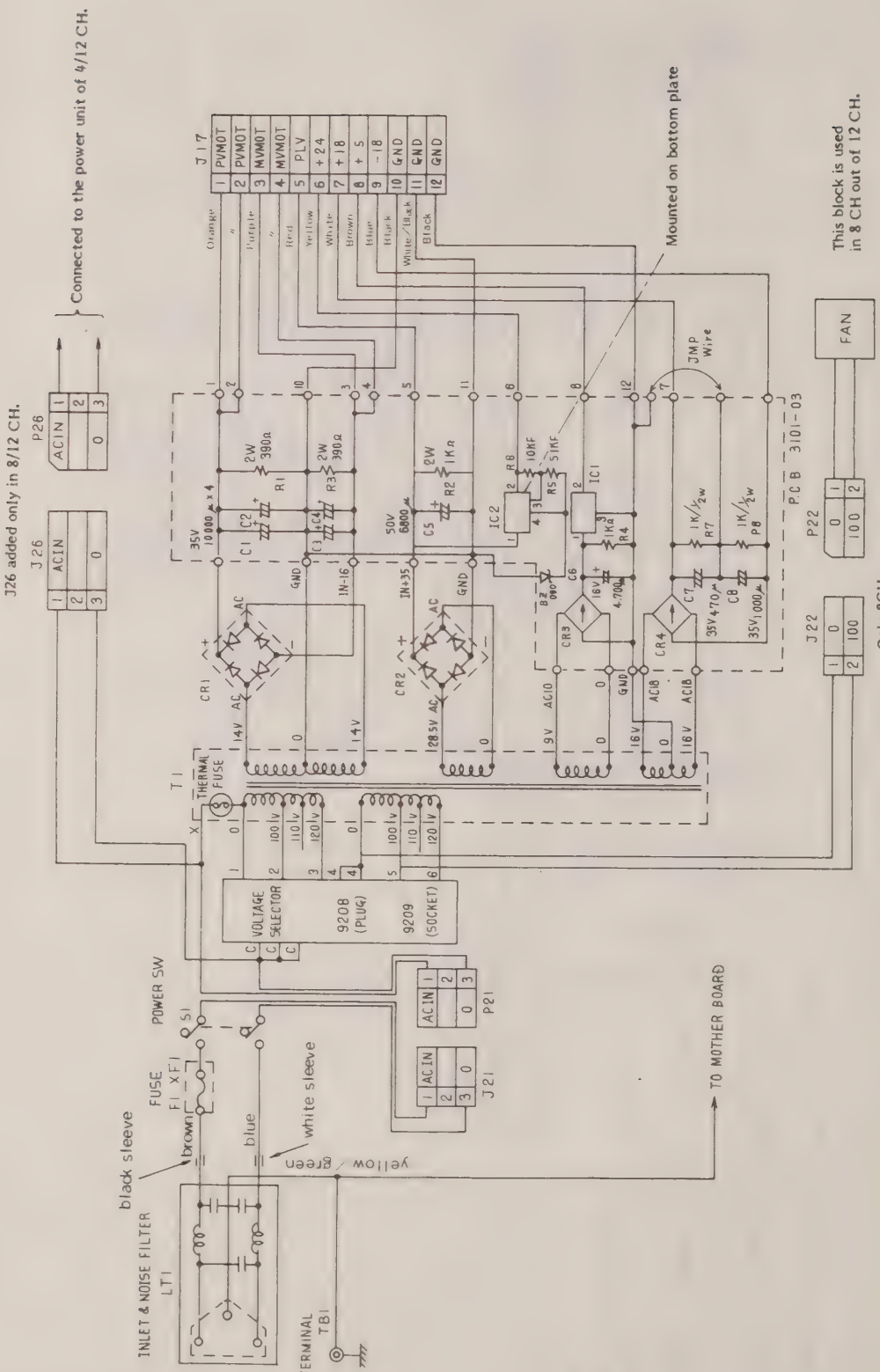
Power Unit (2 CH)

Figure	Part No.	Description	Type	Remarks
R2	501606712	R, Metal Film 1K 2W ±5%	RSF2B-1KJ	
R4	501203716	R, Solid 1K 1/4W ±5%	RC1/4-1KJ	
R5	501303563	R, Metal Film 5.1K 1/4W ±1%	RNE1/4-5.1KF	
R6	501303504	R, " 10K 1/4W ±1%	RNE1/4-10KF	
C5	502102021	C, Electrolytic 6800μ 50WV	ECET50R682 SW	
C6	502102017	C, " 4700μ 16WV	ECEAICS472	
CR1	503103010	Diode Bridge	KBL02	
CR2	"	"	KBL02	
CR3	503100022	Diode Bridge AC140V 1.5A	WO2M	
CR4	"	" " "	WO2M	
CR5	503100011	Di, Zener 9V 1W ±5%	BZ090	
IC1	503300128	IC, Voltage Regulator 5V	UPC7805H	
IC2	503300129	IC, "	UA78HGSC	
J17	513201202	Connector, Receptacle 12P	1625-12R-1	
CNP	513400002	Contact Pin	1855 TL	x 10, For J17
J26	513200203	Connector, Receptacle 2P	1625-2R-1	
CNP	513400002	Contact Pin	1855TL	x 2, For J26
T1	510310010	Transformer	WR3101-2CH	
P21	513200301	Connector, Plug 3P	1625-3P-1	
CNP	513400021	Contact Pin	1560TL	x 2, For P21
PCB	511310140	Printed Circuit Board	3101-14B	POWER BOARD

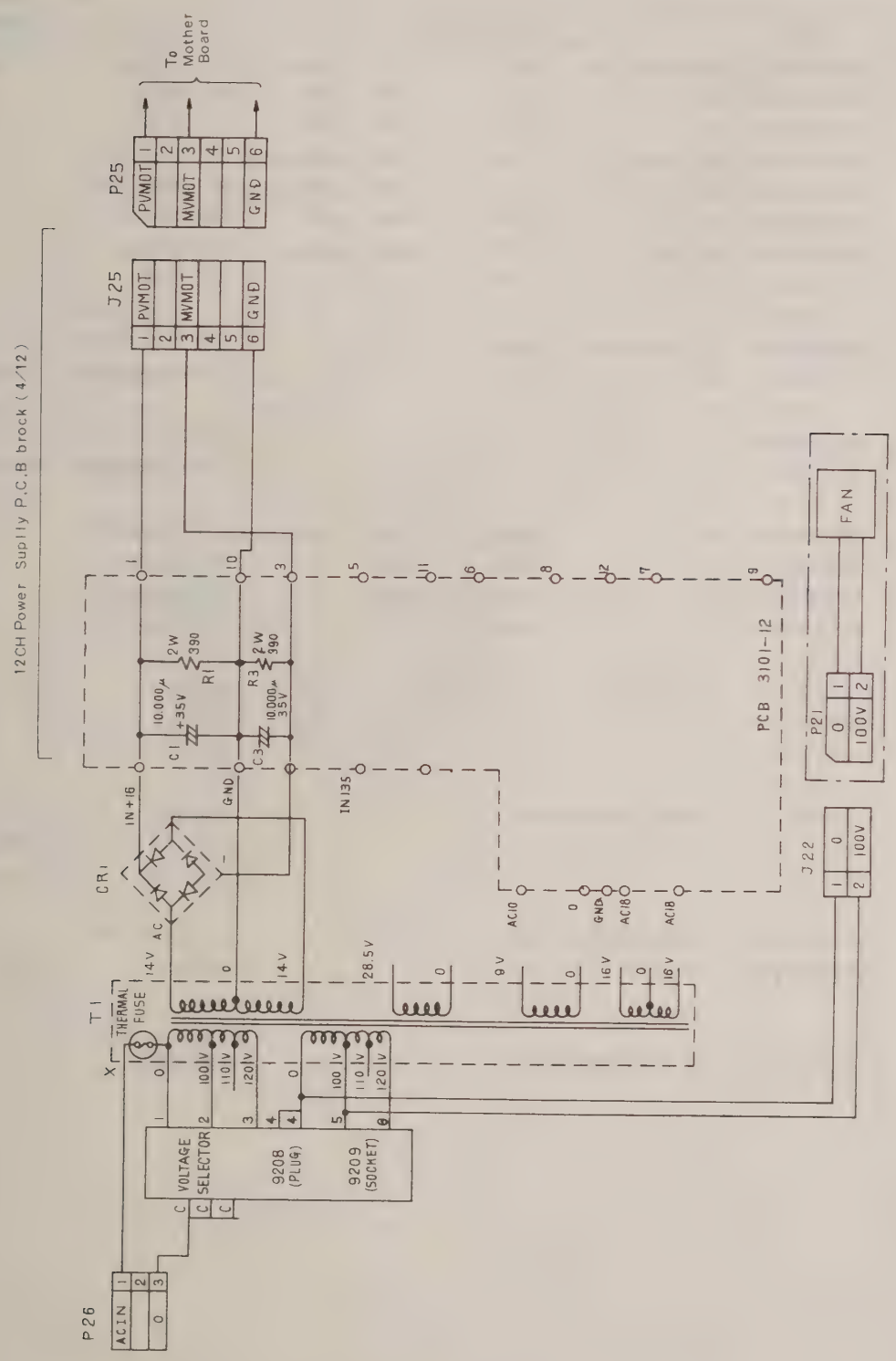
Power Unit (4 CH)



Power Unit (6 CH, 8 CH, 8/12 CH)



Power Unit (4/12 CH)



Power Unit (4 CH, 6 CH, 8 CH)

Figure	Part No.	Description				Type	Remarks
R1	501607611	R, Metal Film	390	1/2W	±5%	RSF2B-390J	
R2	501606712	R, "	1K	1/2W	±5%	RSF2B-1KJ	
R3	501606711	R, "	390	1/2W	±5%	RSF2B-390J	
R4	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R5	501303563	R, Metal Film	5.1K	1/4W	±1%	RNE1/4-5.1KF	
R6	G501303524	R, "	10K	1/4W	±1%	RNE1/4-10KF	
R7	501204719	R, Solid	1K	1/2W	±5%	RC1/2-1KJ	
R8	501204719	R, "	1K	"	"	RC1/2-1KJ	
C1	502102018	C, Electrolytic	10000μ	35WV		ECET35R103SW	
C2	502102018	C, "	"	"		ECET35R103SW	For 6 CH, 8 CH
C3	502102018	C, "	"	"		ECET35R103SW	
C4	502102018	C, "	"	"		ECET35R103SW	For 6 CH, 8 CH
C5	502102021	C, "	6800μ	50WV		ECET50R682SW	
C6	502102017	C, "	4700μ	16WV		ECEAICS472	
C7	502503018	C, "	470μ	35WV		35ULB470-M	
C8	502102019	C, "	1000μ	"		ECEAIVS102	
CR3	G503100022	Diode Bridge	AC140V		1.5A	W02M	
CR4	G503100022	"	"		"	W02M	
CR5	A503100011	Di, Zener	9V	1W	±5%	BZ090	
PCB	511310030	Printed Circuit Board				3101-03C	For 6 CH, 8 CH
PCB	513400002	"				3101-12C	For 4 CH
J17	G513201202	Connector, Receptacle		12P		CN-1625-12R-1,	
CNP	G513400002	Contact Pin				1855TL	x 12, For J17
IC1	503300128	IC, Voltage Regulator		5V		UPC7805H	

Figure	Part No.	Description		Type	Remarks
CR1	503103013	Diode Bridge		KBPC25-02	
CR2	513103013	"		KBPC25-02	
	513501001	AC Selector Plug		9208,	
	513501002	AC Selector Socket		9209,	
J22	513200203	Connector Receptacle	2P	CN, 1625-02R-1	
CNP	G513400002	Contact Pin		CNP, 1855TL	x 2, For J22
P21	G513200301	Connector Plug	3P	CN-1625-2P-1	
CNP	513400021	Contact Pin		CNP, 1560TL	x 2, For P21
IC2	503300129	IC, Voltage Regulator		UA78HGSC	
T1	510310030	Transformer		WR3101-8CH	For 6 CH, 8 CH
T1	510310020	"		WR3101-4CH	For 4 CH

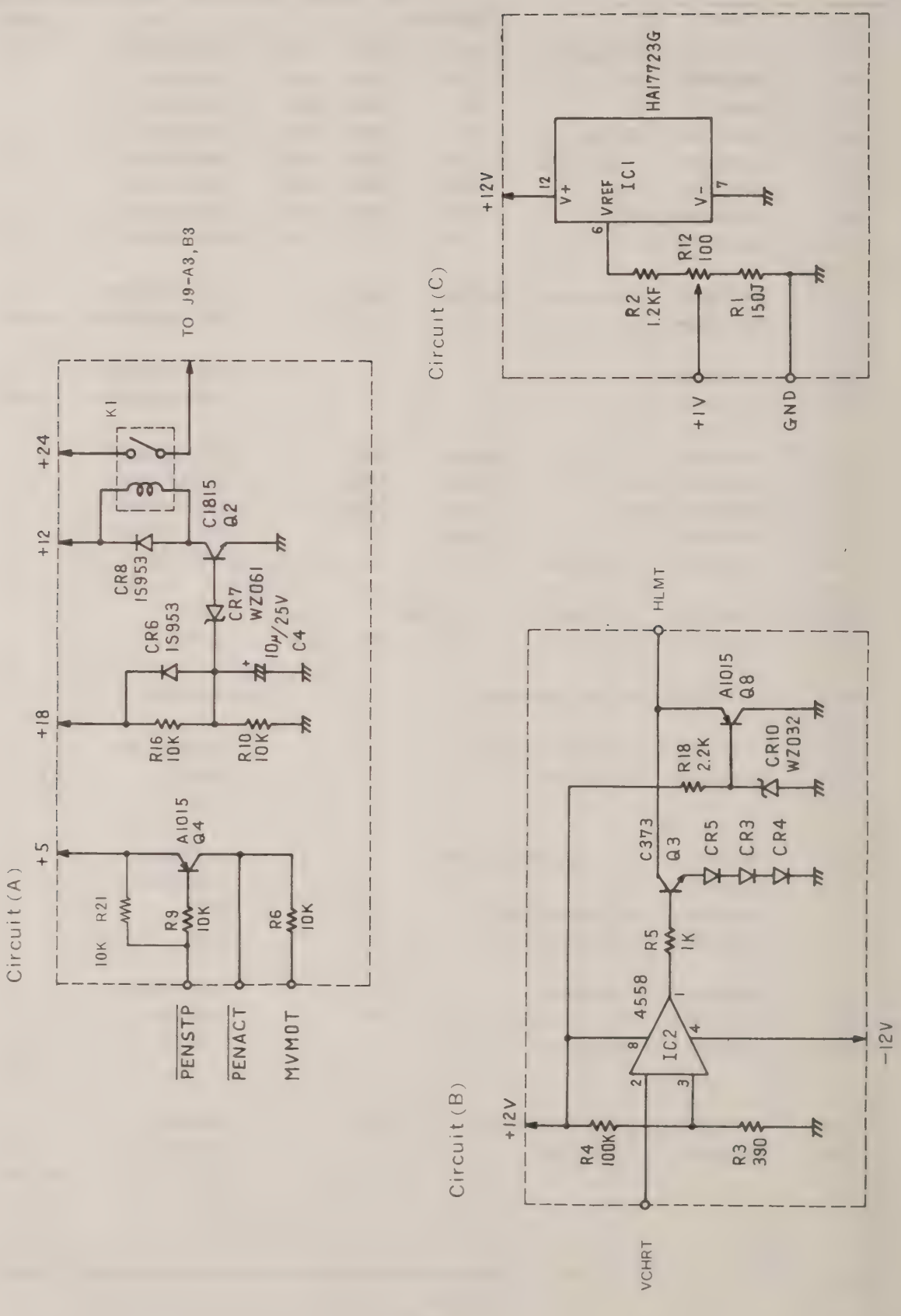
Power Unit (12 CH – 4/12)

Figure	Part No.	Description	Type	Remarks
R1	501606711	R, Metal Film 390 2W ±5%	RSF2B-390J	
R3	"	R, " " " "	"	
C1	502102018	C, Electrolytic 10000μ 35WV	ECET35R103SW	
C3	"	C, " " "	"	
J25	513200602	Connector, Receptacle 6P	1625-6R-1	
CNP	513400002	Contact Pin	1855TL	x 3, For J25
PCB	513400002	Printed Circuit Board	3101-12C	
CR1	503103013	Diode Bridge	KBPC25-02	
T1	510310020	Transformer	WR3101-4CH	
	513501001	AC Selector, Plug	9208,	
	513501002	AC Selector, Socket	9209.	
J22	513200203	Connector, Receptacle 2P	1625-02R-1	
CNP	513400002	Contact Pin	1855TL	x 2, For J22
P26	513200301	Connector, Plug 3P	1625-3P-1	
CNP	513400021	Contact Pin	1560TL	x 2, For P26

Power Unit (12 CH – 8/12)

Figure	Part No.	Description				Type	Remarks
R1	501606711	R, Metal Film	390	1/2W	±5%	RSF2B-390J	
R2	501606712	R, "	1K	1/2W	±5%	RSF2B-1KJ	
R3	501606711	R, "	390	1/2W	±5%	RSF2B-390J	
R4	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R5	501303563	R, Metal Film	5.1K	1/4W	±1%	RNE1/4-5.1KF	
R6	G501303504	R, "	10K	1/4W	±1%	RNE1/4-10KF	
R7	501204719	R, Solid	1K	1/2W	±5%	RC1/2-1KJ	
R8	501204719	R, "	1K	"	"	RC1/2-1KJ	
C1	502102018	C, Electrolytic	10000μ	35WV		ECET35R103SW	
C2	502102018	C, "	"	"		ECET35R103SW	For 6 CH, 8 CH
C3	502102018	C, "	"	"		ECET35R103SW	
C4	502102018	C, "	"	"		ECET35R103SW	For 6 CH, 8 CH
C5	502102021	C, "	6800μ	50WV		ECET50R682SW	
C6	502102017	C, "	4700μ	16WV		ECEAICS472	
C7	502503018	C, "	470μ	35WV		35ULB470-M	
C8	502102019	C, "	1000μ	"		ECEAIVS102	
CR1	513103013	Diode Bridge				KBPC25-02	
CR2	"	"				"	
CR3	G503100022	Diode Bridge	AC140V		1.5A	WO2M	
CR5	A503100011	Di, Zener	9V	1W	±5%	BZ090	
PCB	511310030	Printed Circuit Board				3101-03C	
J17	G513201202	Connector, Receptacle		12P		CN-1625-12R-1	
CNP	G513400002	Contact Pin				1855TL	x 12, For J17
IC1	503300128	IC, Voltage Regulator 5V				UPC7805H	
IC2	503300129	IC, "				UA78HGSC	
	513501001	AC Selector, Plug				9208,	
	513501002	AC Selector, Socket				9209,	
T1	510310030	Transformer				WR3101-8CH	
P21	513200301	Connector, Plug		3P		1625-3P-1	
CNP	513400021	Contact Pin				1560TL	x 2, For P21
J26	513200302	Connector, Receptacle		3P		1625-3R	
CNP	513400022	Contact Pin				1561TL	x 2, For J26

Mother Board

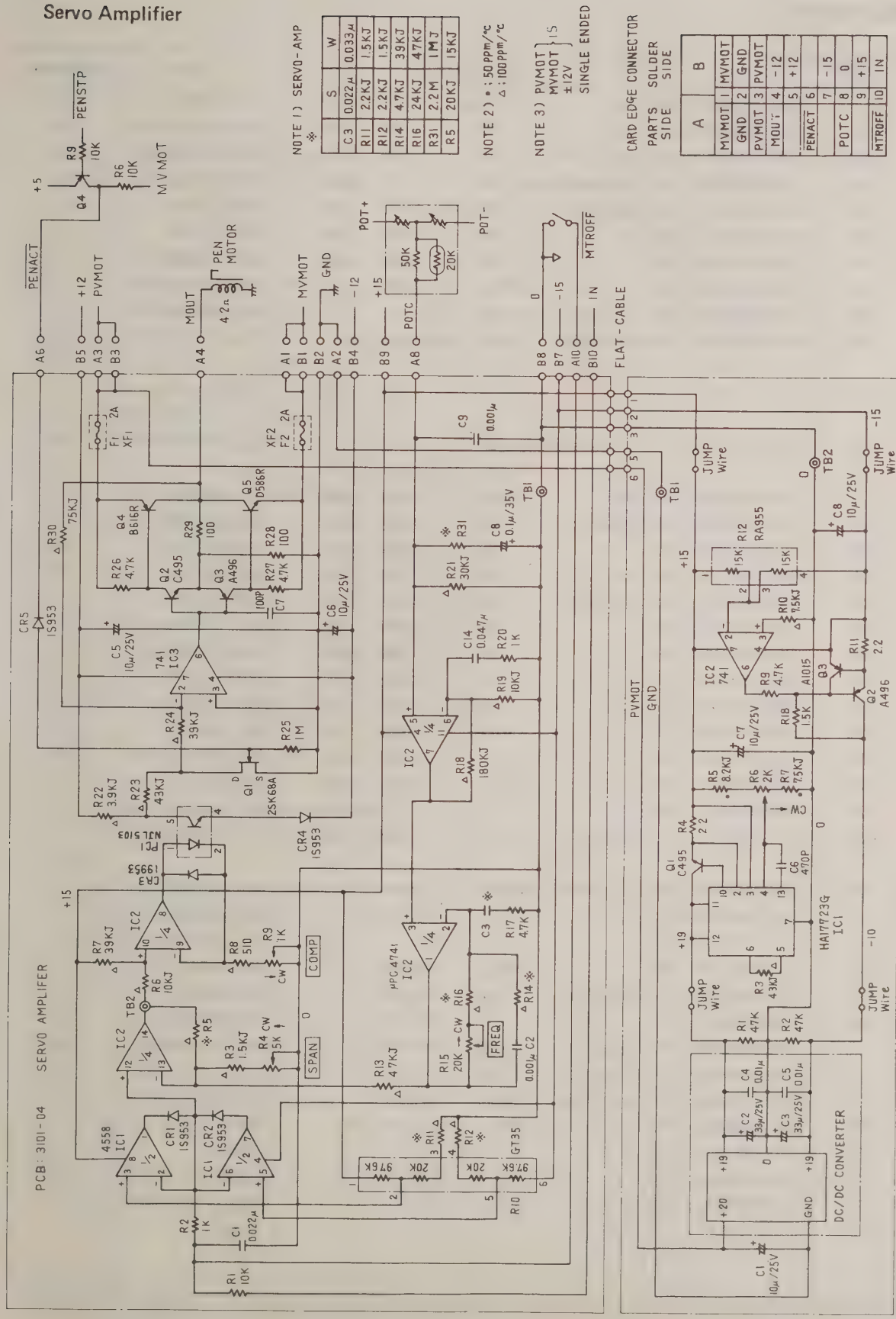


Mother Board

Figure	Part No.	Description	Type	Remarks
R1	501443721	R, Metal Film 150 1/4W ±5%	RP42C-150J	
R2	G501443503	R, " 1.2K 1/4W ±1%	RP42C-1.2KF	
R3	501303719	R, " 390 1/4W ±5%	RNE1/4-390J	
R4	501303771	R, " 100K 1/4W ±5%	RNE1/4-100KJ	
R5	G501203716	R, Solid 1K 1/4W ±5%	RC1/4-1KJ	
R6	501203725	R, " 10K 1/4W ±5%	RC1/4-10KJ	
R7	501105707	R, Carbon 330 1W ±5%	ERG1ANJ331	For 2, 4 CH
R8	"	R, " " " "	"	
R9	501203725	R, Solid 10K 1/4W ±5%	RC1/4-10KJ	
R10	501203725	R, " " " "	RC1/4-10KJ	
R12	G501203721	R, Trimmer Cermet 100	RJ6P-100	
R16	501203725	R, Solid 10K 1/4W ±5%	RC1/4-10KJ	
R18	501203719	R, " 2.2K " "	RC1/4-2.2KJ	
R13′	501204701	R, Solid 4.7K 1/4W ±5%	RC1/4-4.7KJ	For 2CH
R14′	"	R, " " " "	"	"
R15′	501606711	R, Metal Film 390 2W ±5%	RSF2B-390J	"
R16′	"	R, " " " " "	"	"
R20	501203707	R, Solid 220 1/4W ±5%	RC1/4-220J	
R21	501203725	R, " 10K 1/4W ±5%	RC1/4-10KJ	
C4′	502102015	C, Electrolytic 6800μ 35WV	ECET35R682SW	For 2CH
C5′	"	C, " 6800μ "	"	"
C6′	502102016	C, " 470μ 35WV	ECEA1VS471	For 2CH
C7′	"	C, " "	"	"
C1-X	502601003	C, Oil 0.047μ 630WV	PMA-2J-473	x CH
C2	502103023	C, Electrolytic 10μ 25WV	SM25VB-10	
C3	"	C, " " "	"	
C4	"	C, " " "	"	
C8	502303005	C, Metal Film 0.047μ 50WV	MFL-05S47	
CR1	503100021	Di, Si V_R = 200V I_F = 1.1A	V06C	
CR2	"	Di, " " "	"	
CR3	503100020	Di, " V_R = 30V I_F = 0.1A	IS953	
CR4	"	Di, Si " "	"	
CR5	"	Di, " " "	"	
CR6	"	Di, " " "	"	
CR7	503100001	Di, Zener 6.1V 0.5W ±5%	WZ061	
CR8	503100020	Di, Si V_R = 30V I_F = 0.1A	IS953	
CR10	503100052	Di, Zener 3.2V 0.5W ±5%	WZ032	
IC1	503300117	IC, Voltage Regulator	HA17723G	
IC2	503300054	IC, Op-Amp Dual	NJM4558D	
IC3	503300115	IC, Voltage Regulator	UPC7912H	
IC4	503300116	IC, " "	UPC7812H	
Q2	503103014	T, NPN 30V 100mA 200mW	2SC1815, Y	2SC373
Q3	"	T, " " " "	"	"

Figure	Part No.	Description	Type	Remarks
Q4	503203016	T, PNP −30V −100mA 200mV	2SA1015, Y	2SA495
Q8	"	T, " " " "	"	"
J8-X	513300604	Connector 10P x 2	225J21021-487	x CH
J9-X	"	" "	"	x CH
J10-X	"	" "	"	x CH
P11	513400040	" , Pin Holder 10P	HNC2-2.5P10DS	
P12	513400039	" " 3P	HNC2-2.5P3DS	
P13	"	" " 3P	"	
P14	513400038	" " 2P	HNC2-2.5P2DS	
P17	513201201	" , Plug 12P	1625-12P-1	
CNP	513400001	Contact Pin	1854TL	x 12, For P17
P26	513200202	Connector, Plug 2P	1625-2P-1	X2 For P26 } For 2 CH
CNP	513400001	Contact Pin	1854TL	
K1	515100004	Relay DC12V 360Ω	MZ12H	
PCB	511310180	Printed Circuit Board	3101-18B	For 2 CH
PCB	511310150	"	3101-15B	For 4 CH
PCB	511310190	"	3101-19A	For 6 CH
PCB	511310010	"	3101-01C	For 8 CH
BB1	514200309	Bus Bar 135mm, with Tube	T115-45-135I	For 4 CH, 12 CH
BB2	"	" " "	"	
BB3	514200310	" " "	T115-45-135	
BB1	514200313	Bus Bar 225mm with Tube	T115-45-225I	For 6 CH
BB2	"	" " "	"	
BB3	514200314	" " "	T115-45-225	
BB1	514200311	Bus Bar 315mm, with Tube	T115-45-315I	For 8 CH, 12 CH
BB2	"	" " "	"	
BB3	514200312	" "	T115-45-315	
BB1	514200307	Bus Bar 45mm, with Tube	T115-45-45I	For 2 CH
BB2	"	" " "	"	
BB3	514200308	" "	T115-45-45	
PCB	511310160	Printed Circuit Board	3101-16B	For 12 CH
PCB	511310170	"	3101-17B	
P25	513200601	Connector, Plug 6P	1625-6P-1	x 3 For 12 CH
CNP	513400001	Contact Pin	1854TL	

Servo Amplifier



Servo Amplifier

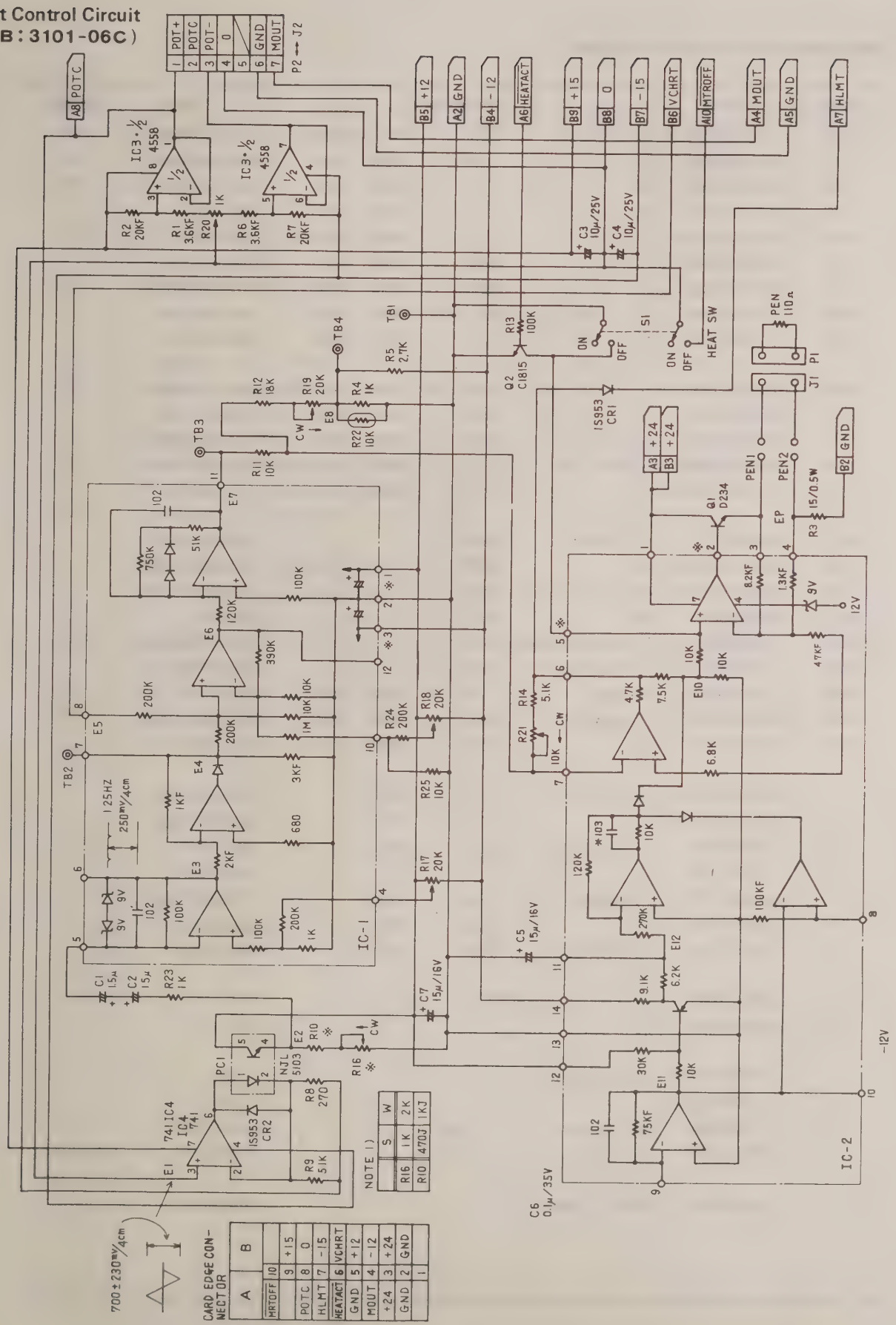
Figure	Part No.	Description				Type	Remarks
R1	G501263725	R, Solid	10K	1/4W	±5%	RC1/4-10KJ	
R2	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R3	G501303750	R, Metal Film	1.5K	1/4W	±5%	RNE1/4-1.5KJ	
R4	504207048	R, Trimmer Cermet	5K			TM10KPH-5K	
R5	B501303770	R, Metal Film	20K	1/4W	±5%	RNE1/4-20KJ	
R6	G501303708	R, "	10K	1/4W	±5%	RNE1/4-10KJ	
R7	501303793	R, "	39K	1/4W	±5%	RNE1/4-39KJ	
R8	G501303731	R, "	510	1/4W	±5%	RNE1/4-510J	
R9	504207049	R, Trimmer Cermet	1K			TM10KPH-1K	
R10	A501003311	Resistor Array	(20K x 2) + (97.6K x 2)			TG35	
R13	G501303733	R, "	4.7K	1/4W	±5%	RNE1/4-4.7KJ	
R15	G504207031	R, Trimmer Cermet	20K			TM10KPH-20K	
R17	G501203722	R, Solid	4.7K	1/4W	±5%	RC1/4-4.7KJ	
R18	501303781	R, Metal Film	180K	1/4W	±5%	RNE1/4-180KJ	
R19	G501303708	R, "	10K	1/4W	±5%	RNE1/4-10KJ	
R20	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R21	G501303718	R, Metal Film	30K	1/4W	±5%	RNE1/4-30KJ	
R22	G501303729	R, "	3.9K	1/4W	±5%	RNE1/4-3.7KJ	
R23	G501303768	R, "	43K	1/4W	±5%	RNE1/4-43KJ	
R24	501303793	R, "	39K	1/4W	±5%	RNE1/4-39KJ	
R25	G501203738	R, Solid	1M	1/4W	±5%	RC1/4-1MJ	
R26	G501203722	R, "	4.7K	1/4W	±5%	RC1/4-4.7KJ	
R27	G501203722	R, "	"	"	"	RC1/4-4.7KJ	
R28	G501203707	R, "	100	1/4W	±5%	RC1/4-100 J	
R29	G501203707	R, "	"	"	"	RC1/4-100 J	
R30	G501303757	R, Metal Film	100	1/4W	±5%	RNE1/4-7.5KJ	
C1	G502303008	C, Myler Film	0.022μ	50WV		MFL-05S22	
C2	G502303002	C, "	0.001μ	50WV		MFL-05DI	
C4	G502303005	C, "	0.047μ	50WV		MFL-05S47	
C5	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C6	502103023	C, "	"	"		SM25VB-10	
C7	G502403009	C, Ceramic	100P	50WV		UFD04-101K-K2J	
C8	G502203012	C, Tantalum	0.1μ	35WV		CS15EIV0R1M	
C9	G502303002	C, Myler Film	0.001μ	50WV		MFL-05DI	
CR1	G503100020	Di, Si	V_R = 30V	I_F = 0.1A		IS953	
CR2	G503100020	Di, Si	"	"		IS953	
CR3	G503100026	Di, "	"	"		IS953	
CR4	G503100020	Di "	"	"		IS953	
CR5	G503100020	Di, "	"	"		IS953	

Figure	Part No.	Description				Type	Remarks
IC1	G503300054	IC, Op-Amp	Dual			NJM4558D	
IC2	A503300034	IC, "	Quad			UPC474IC	
IC3	A503300025	IC, Op-Amp				NJM741D	TA7504P
PC1	A503300108	Photo Coupler	I_F = 70mA,	I_C = 100mA		NJL5103D	
			60% ≤ CTR ≤ 150%				
Q1	503203015	T, N-J-FET				2SK68A	
Q2	G503200011	T, NPN	50V	1A	1W	2SC495, O	
Q3	G503200010	T, PNP	–50V	–1A	1W	2SA496, O	
Q4	G503200018	T, PNP	–80V	–5A	60W	2SB616, R	
Q5	G503200021	T, NPN	80V	5A	60W	2SD586, R	
TB1	B513400027	Test Terminal				LC-1-G	
TB2	B513400027	"				LC-1-G	
FX1	512400008	Fuse Holder				OG751-0056	
FX1'	512400008	"				OG751-0056	
FX2	512400008	"				OG751-0056	
FX2'	512400008	"				OG751-0056	
F1	512300011	Fuse	2A			7142-2A,	
F2	512300011	"	2A			7142-2A	
FC	520110061	Flat Cable	6 Pin			JVU–,1-35-3P254	
PCB	511310040	Printed Circuit Board				3101-04B	
	520100030	Insulating Washer				B-18	x 4
	003317130	Insulating Sheet					x 2
R11	501303766	R, Metal Film	2.2K	1/4W	±5%	RNE1/4-2.2KJ	For Type S
"	501303750	R, "	1.5K	"	"	RNE1/4-1.5KJ	" W
R12	501303766	R, "	2.2K	"	"	RNE1/4-2.2KJ	" S
"	501303750	R, "	1.5K	"	"	RNE1/4-1.5KJ	" W
R14	501303733	R, "	4.7K	"	"	RNE1/4-4.7KJ	" S
"	501303793	R, "	39K	"	"	RNE1/4-39KJ	" W
R16	501303732	R, "	24K	"	"	RNE1/4-24KJ	" S
"	501303741	R, "	47K	"	"	RNE1/4-47KJ	" W
R31	501203740	R, Solid	2.2M	"	"	RC1/4-2.2MJ	" S
"	501203738	R, "	1M	"	"	RC1/4-1MJ	" W
C3	502303008	C, Myler Film	0.022μ	50WV		MFL-05S22	For Type S
"	502303009	C, "	0.033μ	50WV		MFL-05-S33	" W

Stabilizer

Figure	Part No.	Description				Type	Remarks
R1	501203751	R, Solid	47K	1/4W	±5%	RC1/4-47KJ	
R2	"	R, "	"	"	"	"	
R3	501303745	R, Metal Film	4.3K	1/4W	±5%	RNE1/4-4.3KJ	
R4	501203701	R, Solid	2.2	1/4W	±5%	RC1/4-2.2J	
R5	501443719	R, Metal Film	8.2K	1/4W	±5%	RP42C8.2KJ	
R6	505103009	R, Trimmer Cermet	2K			RJ6X-2K	
R7	501442720	R, Metal Film	7.5K	1/4W	±5%	RP42C7.5KJ	
R8	501203718	R, Solid	1.5K	1/4W	±5%	RC1/4-1.5KJ	
R9	501203722	R, "	4.7K	1/4W	±5%	RC1/4-4.7KJ	
R10	501303720	R, Metal Film	7.5K	1/4W	±5%	RNE1/4-7.5KJ	
R11	501203701	R, Solid	2.2	1/4W	±5%	RC1/4-2.2J	
R12	501003313	Resistor Array	15K x 2			RA955	
C1	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C2	502103011	C, "	33μ	25WV		SL25VB-33	
C3	"	C, "	"	"		"	
C4	502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C5	"	C, "	"	"		"	
C6	502403003	C, "	470P	"		USD04-SL-471K	
C7	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C8	"	C, "	"	"		"	
IC1	503300117	IC, Voltage Regulator				HA17723G	
IC2	503300025	IC, Op-Amp				TA7504P	NJM741D
Q1	503200011	T, NPN	50V	1A	1W	2SC495, 0	
Q2	503200010	T, PNP	–50V	1A	1W	2SA496, 0	
Q3	503200002	T, PNP	–30V	–100mA	200mW	2SA1015, Y	2SA495
TB1	513400027	Test Terminal				LC-1-G	
TB2	"	"				"	
Con V	518100004	DC/DC Converter				CE-0134	
PCB	511310050	Printed Circuit Board				3101-05B	

Heat Control Circuit (PCB: 3101-06C)



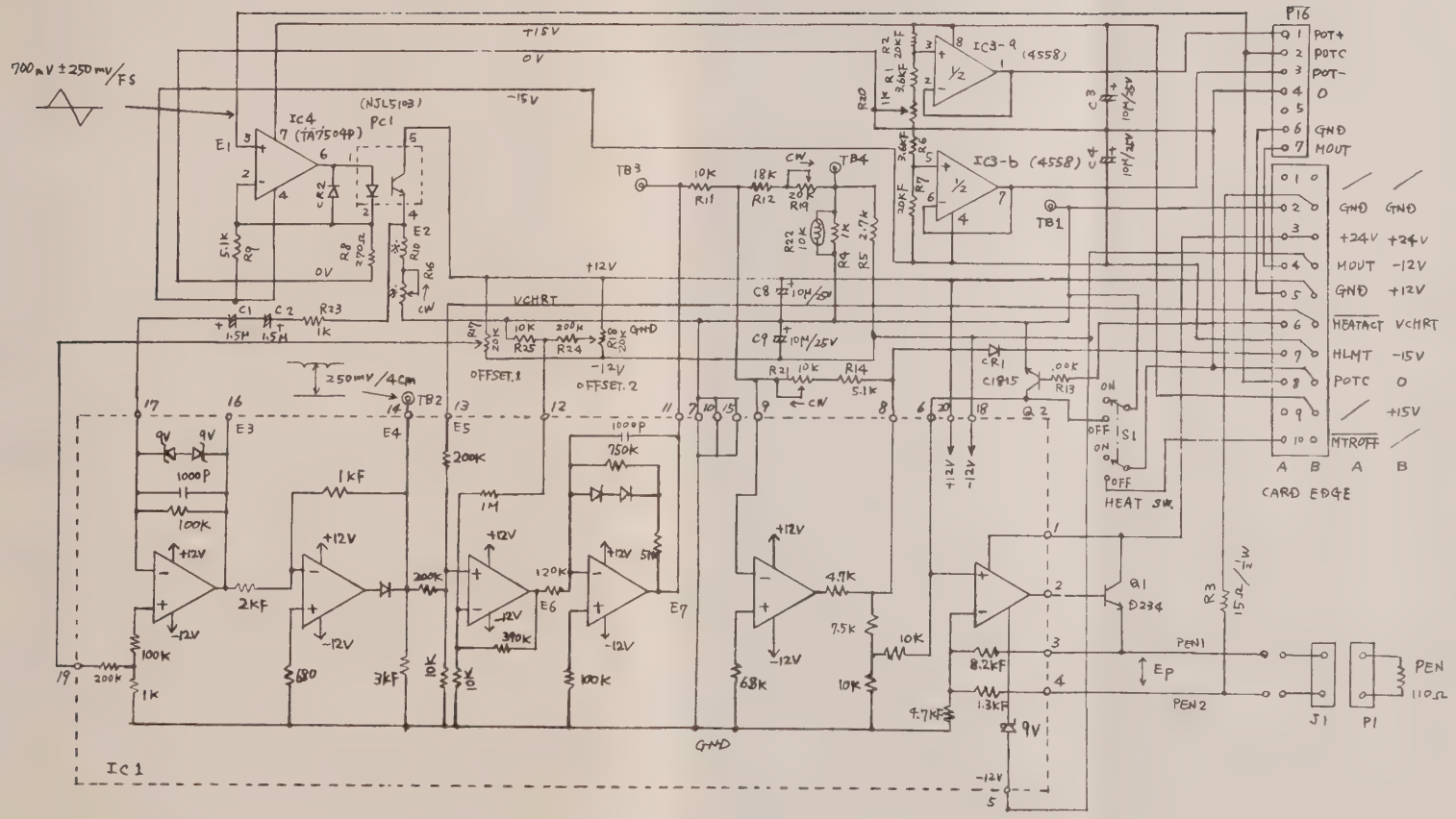
Heat Control Circuit (PCB: 3101-06C)

Figure	Part No.	Description				Type	Remarks
R1	501303565	R, Metal Film	3.6K	1/4W	±1%	RNE1/4-3.6KF	
R2	G501303518	R, "	20K	1/4W	±1%	RNE1/4-20KF	
R3	G501304701	R, "	15	1/2W	±5%	RNE1/2-15J	
R4	G501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R5	G501810327	R, "	2.7K	1/4W	±1%	RN1/4-2.7KF	
R6	G501303764	R, "	3.6K	1/4W	±1%	RNE1/4-3.6KF	
R7	G501303518	R, "	20K	1/4W	±1%	RNE1/4-20KF,	
R8	501303794	R, "	270	1/4W	±5%	RNE1/4-270J	
R9	G501303758	R, "	5.1K	1/4W	±5%	RNE1/4-5.1KJ	
R11	G501303708	R, "	10K	1/4W	±5%	RNE1/4-10KJ	
R12	G501303746	R, "	18K	1/4W	±5%	RNE1/4-18KJ	
R13	G501203731	R, Solid	100K	1/4W	±5%	RC1/4-100KJ	
R14	G501303758	R, Metal Film	5.1K	1/4W	±5%	RNE1/4-5.1KJ	
R15	501303566	R, "	33K	1/4W	±1%	RNE1/4-33KF	
R17	G504207031	R, Trimmer	20K			TM10KPH-20K	
R18	G504207031	R, "	20K			TM10KPH-20K	
R19	A505103023	R, Trimmer Cermet	20K			RJ6X-20K	
R20	G505103011	R, " "	1K			RJ6X-1K	
R21	504103021	R, Variable Carbon	10K			RV16YP20SB10K	
R22	B503400005	R, Thermister	10K			10KD7-15%	
R23	501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R24	G501303760	R, Metal Film	200K	1/4W	±5%	RNE1/4-200KJ	
R25	G501303708	R, "	10K	1/4W	±5%	RNE1/4-10KJ	
C1	A502203024	C, Tantalum	1.5μ	16WV		CS15EICIR5M	
C2	A502203024	C, "	"	"		CS15EICIR5M	
C3	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C4	502103023	C, "	"	"		SM25VB-10	
C5	G502203014	C, Tantalum	15μ	16WV		CS15EIC150M	
C6	502101022	C, "	0.1μ	35WV		SSV350R1	
C7	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
CR1	G503100020	Di, Si	V_R = 30V	I_F = 0.1A		IS953	
CR2	G503100020	Di, "	"	"		IS953	
IC1	503300149	Resistor Array				GT85A	
IC2	503300150	"				GT86A	
IC3	G503300054	IC, Op-Amp	Dual			NJM4558D	
IC4	G503300025	IC, "				TA7504P	NJM7410
S1	508102013	Switch, Toggle				M-2022H	

Figure	Part No.	Description	Type	Remarks
TB1	B513400027	Test Terminal	LC-1-G	
TB2	B513400027	"	LC-1-G	
TB3	B513400027	"	LC-1-G	
PCB	511310060	Printed Circuit Board	3101-06C	
PC1	A503300108	Photo Coupler I_F = 70mA I_C = 100mA 60% ≤ CTR ≤ 150%	NJL5103D	
Q1	G503200015	T, NPN 3A 60V 1.5W	2SD234, O	
Q2	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	2SC373
J1	A513200201	Connector, Socket 2P	S-I0320,	
P2	513400049	Connector, Pin Header 7P	HNC2-2.5P.7DS	
J2	513400047	Connector, Receptacle 7P	HNC2-2.5S7	
CNP	513400042	Contact Pin	HNC-2.5S-B	x 6, For J2
	B520100012	Insulating sheet	30B6001	
	B520100013	Insulating washer	AC316A	
R10	501303704	R, Metal Film 470 1/4W ±5%	RNE1/4-470J	For Type S
"	501303717	R, " 1K " "	RNE1/4-1KJ	" W
R16	505103711	R, Trimmer Cermet 1K	RJ6X-1K	" S
"	504103009	R, " 2K	RJ6X-2K	" W

Heat Control Circuit

(NEW TYPE
PCB: 3101-06E (EC))



Note 1)

	S	W
R10	470Ω	1K
R16	1K	2K

Note 2)

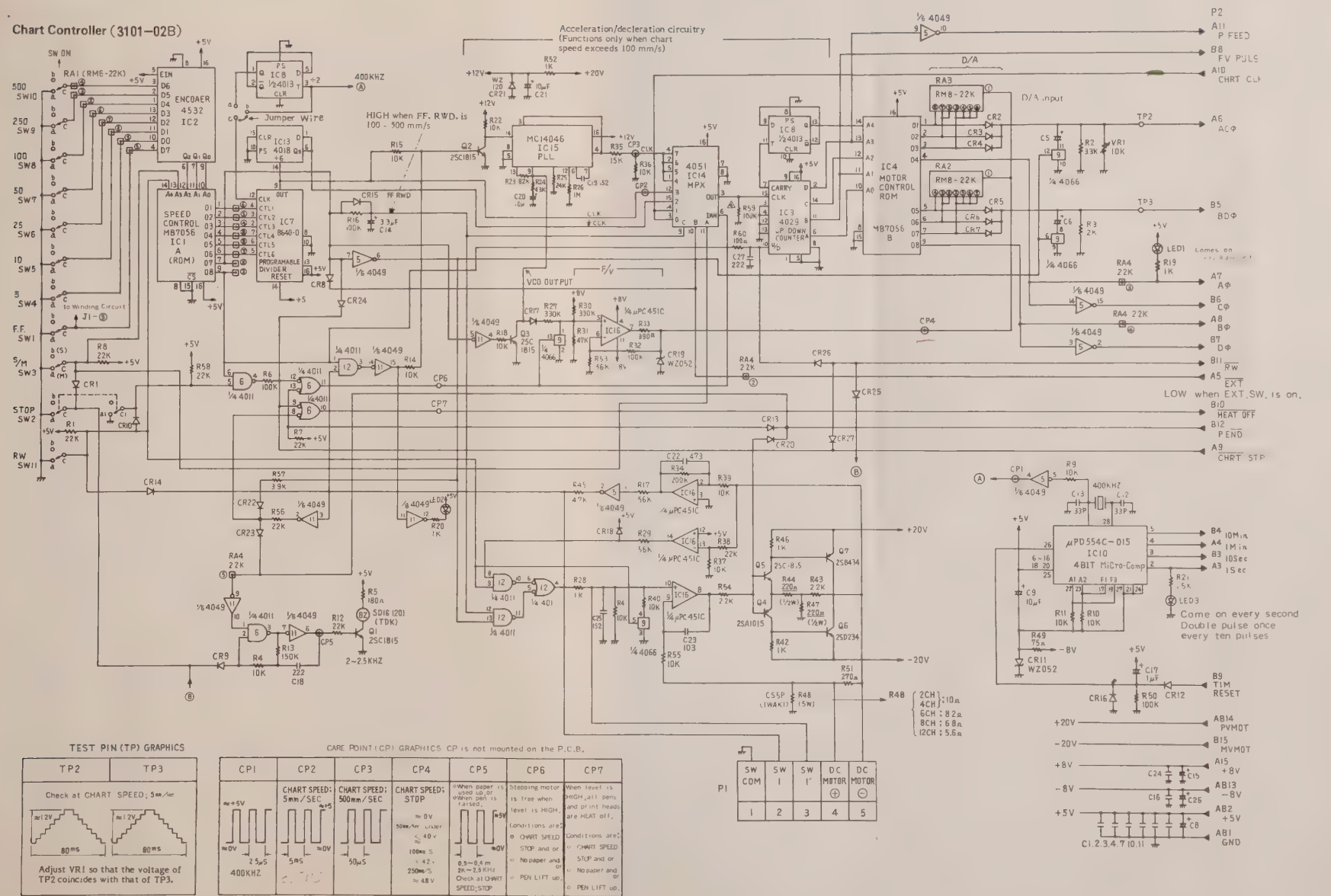
TB3 ≒ −1.25V at 10cm/s
−3.3V at 100cm/s

Heat Control Circuit (PCB: 3101-06E (EC))

Figure	Part No.	Description				Type	Remarks
R1	G501810336	R, Metal Film	3.6K	1/4W	±1%	RN1/4-3.6KF	
R2	G501810420	R, "	20K	1/4W	±1%	RN1/4-20KF	
R3	G501304701	R, "	15	1/2W	±5%	RNE1/2-15J	
R4	G501810310	R, "	1K	1/4W	±1%	RN1/4-1KF	
R5	G501810327	R, "	2.7K	1/4W	±1%	RN1/4-2.7KF	
R6	G501810336	R, "	3.6K	1/4W	±1%	RN1/4-3.6KF	
R7	G501810420	R, "	20K	1/4W	±1%	RN1/4-20KF	
R8	G501810227	R, "	270	1/4W	±1%	RN1/4-270F	
R9	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R11	G501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
R12	G501810418	R, "	18K	1/4W	±1%	RN1/4-18KF	
R13	G501810510	R, "	100K	1/4W	±1%	RN1/4-100KF	
R14	G501810351	R, "	5.1K	1/4W	±1%	RN1/4-5.1KF	
R17	G504207031	R, Trimmer	20K			TM10KPH-20K	
R18	G504207031	R, "	20K			TM10KPH-20K	
R19	A505103023	R, Trimmer Cermet	20K			RJ6X-20K	
R20	G505103011	R, " "	1K			RJ6X-1K	
R21	504103021	R, Variable Carbon	10K			RV16YP20SB10K	
R22	B503400005	R, Thermister	10K			10KD7-15%	
R23	501810310	R, Metal Film	1K	1/4W	±1%	RN1/4-1KF	
R24	G501810520	R, "	200K	1/4W	±1%	RN1/4-200KF	
R25	G501810410	R, "	10K	1/4W	±1%	RN1/4-10KF	
C1	A502203024	C, Tantalum	1.5μ	16WV		CS15EICIR5M	
C2	A502203024	C, "	"	"		CS15EICIR5M	
C3	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C4	502103023	C, "	"	"		SM25VB-10	
CR1	G503100020	Di, Si	V_R = 30V	I_F = 0.1A		IS953	
CR2	G503100020	Di, "	"	"		IS953	
IC1	503301152	IC, Hybrid				WS-1801	
IC3	G503300054	IC, Op-Amp	Dual			NJM4558D	
IC4	G503300025	IC, "				TA7504P	NJM741D
S1	508102015	Switch, Toggle				3T201N-RIA	

Figure	Part No.	Description	Type	Remarks
TB1	B513400027	Test Terminal	LC-1-G	
TB2	B513400027	"	LC-1-G	
TB3	B513400027	"	LC-1-G	
PCB	511310060	Printed Circuit Board	3101-06E (EC)	
PC1	A503300108	Photo Coupler I_F = 70mA I_C = 100mA 60% ≤ CTR ≤ 150%	NJL5103D	
Q1	G503200015	T, NPN 3A 60V 1.5W	2SD234, O	
Q2	503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	2SC373
J1	A513200201	Connector, Socket 2P	S-I0320,	
P2	513400049	Connector, Pin Header 7P	HNC2-2.5P.7DS	
J2	513400047	Connector, Receptacle 7P	HNC2-2.5S7	
CNP	513400042	Contact Pin	HNC-2.5S-B	x 6, For J2
	B520100012	Insulating sheet	30B6001	
	B520100013	Insulating washer	AC316A	
R10	501810247	R, Metal Film 470 1/4W ±1%	RN1/4-470F	For Type S
"	501810310	R, " 1K " "	RN1/4-1KF	" W
R16	505103711	R, Trimmer Cermet 1K	RJ6X-1K	" S
"	504103009	R, " 2K	RJ6X-2K	" W

Chart Controller (3101-02B)



TEST PIN (TP) GRAPHICS

TP2	TP3
Check at CHART SPEED; 5mm/sec	
≈12V, 80ms	≈12V, 80ms
Adjust VR1 so that the voltage of TP2 coincides with that of TP3.	

CARE POINT (CP) GRAPHICS CP is not mounted on the P.C.B.

CP1	CP2	CP3	CP4	CP5	CP6	CP7
≈+5V, ≈0V, 2.5µS, 400KHZ	CHART SPEED: 5mm/SEC, ≈+5, ≈0V, 5mS	CHART SPEED: 500mm/SEC, 50µS	CHART SPEED; STOP, ≈0V, 50mm/sec under ≈ 40V, 100mm/S ≈ 42V, 250mm/S ≈ 48V	○When paper is used up, or ○When pen is raised, ≈5V, ≈0V, 0.3~0.4m 2K~2.5KHz Check at CHART SPEED; STOP	Stepping motor is free when level is HIGH. Conditions are; ○ CHART SPEED STOP and or ○ No paper and or ○ PEN LIFT up.	When level is HIGH, all pens and print heads are HEAT off. Conditions are; ○ CHART SPEED STOP and or ○ No paper and or ○ PEN LIFT up.

Chart Controller (3101–02B)

Figure	Part No.	Description	Type	Remarks
IC1	A503300147	IC, NMOS Bipolar Memory	MB7056	
IC2	A503300118	IC, CMOS Encorder	TC4532BP	
IC3	A503300107	IC, CMOS Binary U/D Counter	TC4029BP	
IC4	A503300148	IC, NMOS Bipolar Memory	MB7056	
IC5	A503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC6	A503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC7	A503300100	IC, CMOS Programable Divider	8640-o	
IC8	A503300064	IC, CMOS Dual D Flip-Flop	TC4013BP	
IC9	G503300052	IC, CMOS Dual Bilateral Switch	TC4066BP	
IC10	B503300049	IC, PMOS Micro Computer	μPD554C-015	
IC11	A503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC12	A503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC13	A503300119	IC, CMOS Divide-By-N Counter	TC4018BP	
IC14	A503300113	IC, CMOS 8-Ch, Multiplexer	TC4051BP	
IC15	A503300120	IC, CMOS Phase Locked Loop	MC14046	
IC16	A503300034	IC, Op Amp Quad	μPC4741C	
Q1~3	G503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q4	G503203016	T, PNP –30V –100mA 200mW	2SA1015, Y	
Q5	G503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q6	G503200015	T, NPN 60V 3A 1.5W	2SD234, O	
Q7	G503200007	T, PNP –50V –3A 1.5W	2SB434, O	
CR1~10	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR11	A503100060	Di, Zener 5.2V 0.5W ±5%	WZ052	
CR12~18	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR19	A503100060	Di, Zener 5.2V 0.5W ±5%	WZ052	
CR20	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR21	G503100006	Di, Zener 12.0V 0.5W ±5%	WZ120	
CR22~27	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
LED1~3	A502100017	Di, LED Red I_F = 25mA	TLR102	
R1	G501203727	R, Solid 22K 1/4 ±5%	RC1/4-22KJ	
R2	G501303774	R, Metal Film 3.3K 1/4 ±5%	RNE1/4-3.3KJ	
R3	G501303701	R, Metal Film 2K 1/4 ±5%	RNE1/4-2KJ	
R4	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	
R5	G501203770	R, Solid 180 1/4 ±5%	RC1/4-180J	
R6	G501203731	R, Solid 100K 1/4 ±5%	RC1/4-100KJ	
R7	G501203727	R, Solid 22K 1/4 ±5%	RC1/4-22KJ	
R8	G501203719	R, Solid 2.2K 1/4 ±5%	RC1/4-2.2KJ	
R9~11	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	
R12	G501203727	R, Solid 22K 1/4 ±5%	RC1/4-22KJ	
R13	G501203731	R, Solid 100K 1/4 ±5%	RC1/4-100KJ	
R14, 15	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	

Chart Controller (3101-02B)

Figure	Part No.	Description				Type	Remarks
R16	G501203731	R, Solid	100K	1/4	±5%	RC1/4-100KJ	
R17	G501203730	R, Solid	56K	1/4	±5%	RC1/4-56KJ	
R18	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R19, 20	G501203716	R, Solid	1K	1/4	±5%	RC1/4-1KJ	
R21	G501203718	R, Solid	1.5K	1/4	±5%	RC1/4-1.5KJ	
R22	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R23	501203755	R, Solid	82K	1/4	±5%	RC1/4-82KJ	
R24	G501303745	R, Metal Film	4.3K	1/4	±5%	RNE1/4-4.3KJ	
R25	G501203772	R, Solid	24K	1/4	±5%	RC1/4-24KJ	
R26	G501203738	R, Solid	1M	1/4	±5%	RC1/4-1MJ	
R27	G501303775	R, Metal Film	330K	1/4	±5%	RNE1/4-330KJ	
R28	G501203716	R, Solid	1K	1/4	±5%	RC1/4-1KJ	
R29	G501203730	R, Solid	56K	1/4	±5%	RC1/4-56KJ	
R30	G501303775	R, Metal Film	330K	1/4	±5%	RNE1/4-330KJ	
R31	G501303741	R, Metal Film	47K	1/4	±5%	RNE1/4-47KJ	
R32	G501303705	R, Metal Film	100K	1/4	±5%	RNE1/4-100KJ	
R33	G501303719	R, Metal Film	390	1/4	±5%	RNE1/4-390J	
R34	G501203771	R, Solid	200K	1/4	±5%	RC1/4-200KJ	
R35	G501203726	R, Solid	15K	1/4	±5%	RC1/4-15KJ	
R36, 37	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R38	G501203727	R, Solid	22K	1/4	±5%	RC1/4-22KJ	
R39~41	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R42	G501203716	R, Solid	1K	1/4	±5%	RC1/4-1KJ	
R43	G501203719	R, Solid	2.2K	1/4	±5%	RC1/4-2.2KJ	
R44	A501604703	R, Metal Film	220	1/2	±5%	RSF1/2-220J	
R45	G501203722	R, Solid	4.7K	1/4	±5%	RC1/4-4.7KJ	
R46	G501203716	R, Solid	1K	1/4	±5%	RC1/4-1KJ	
R47	A501604703	R, Metal Film	220	1/2	±5%	RSF1/2-220J	
R48	A501609728	R, Wirewound	10	5	±5%	CS5P-10J	For 2 CH, 4 CH
	A501609729		8.2	5	±5%	CS5P-8.2J	For 6 CH
	A501609730		6.8	5	±5%	CS5P-6.8J	For 8 CH
	A501609731		5.6	5	±5%	CS5P-5.6J	For 12 CH
R49	G501303792	R, Metal Film	75	1/4	±5%	RNE1/4-75J	
R50	G501203731	R, Solid	100K	1/4	±5%	RC1/4-100KJ	
R51	G501203710	R, Solid	270	1/4	±5%	RC1/4-270J	
R52	G501303717	R, Metal Film	1K	1/4	±5%	RNE1/4-1KJ	
R53	G501303722	R, Metal Film	36K	1/4	±5%	RNE1/4-36KJ	
R54	G501203719	R, Solid	2.2K	1/4	±5%	RC1/4-2.2KJ	
R55	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R56	G501203727	R, Solid	22K	1/4	±5%	RC1/4-22KJ	
R57	G501203760	R, Solid	3.9K	1/4	±5%	RC1/4-3.9KJ	
R58	G501203727	R, Solid	22K	1/4	±5%	RC1/4-22KJ	
R59	G501203731	R, Solid	100K	1/4	±5%	RC1/4-100KJ	
R60	G501203707	R, Solid	100	1/4	±5%	RC1/4-100J	

Chart Controller (3101-02B)

Figure	Part No.	Description			Type	Remarks
C1~4	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C5, 6	G502203006	C, Tantalum	0.22μ	35WV	CS15EIVR22M	
C7	G502403007	C, Ceramic	0.01μ	50WV	VLD06-103-L2A	
C8	G502103025	C, Electrolytic	47μ	10WV	SM10VB-47	
C9	G502203002	C, Tantalum	10μ	15WV	CS15EIC100M	
C10, 11	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C12, 13	G502403034	C, Ceramic	33P	50WV	RAU04SL330KL05AE	
C14	G502203003	C, Tantalum	3.3μ	15WV	CS15EIC3R3M	
C15	G502103024	C, Electrolytic	47μ	16WV	SM16VB-47	
C16	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C17	G502203013	C, Tantalum	1μ	35WV	CS15EIV010M	
C18	G502303001	C, Myler Film	2200P	50WV	MFL-05D22	
C19	G502303019	C, Myler Film	1500P	50WV	MFL-05D15	
C21	G502203018	C, Tantalum	10μ	25WV	CS15EIE100M	
C20	G502203002	C, Tantalum	10μ	15WV	CS15EIC100M	
C22	G502303005	C, Myler Film	0.047μ	50WV	MFL-05S47	
C23	G502303004	C, Myler Film	0.01μ	50WV	MFL-05SI	
C24	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C25	G502303019	C, Myler Film	1500P	50WV	MFL-05D15	
C26	G502103024	C, Electrolytic	47μ	16WV	SL16VB-47	
C27	G502403028	C, Ceramic	2200P	50WV	ULD04SA222J-L2A	
RA1	B501002810	Resister Array		±10%	RKC1/8 B8 2.2KK	
RA2, 3	B501002811	Resister Array		±10%	RKC1/8 B8 23KK	
RA4	B501002812	Resister Array		±10%	RKC1/8 B4 2.2KK	
RA5	B501002813	Resister Array		±10%	RKC1/8 B8 10KK	
VR1	G504207015	R, Trimmer, Cermet	10K		TM10KPV10K	
TP1~3	B513400027	Check PIN			LC-1-G	
BZ	A519300001	Buzzer			SD161201	
X1	A519105001	X Crystal Osillator	400KHz		HC-6/UW-400KHz	
SW1	A508201013	Switch Push Non-Lock			KSD1-2-0NLDC	
SW2, 3	A508213003	Switch Push Lock			KSD2-4-10LLDC	
SW4~10	A508207001	Switch Push Lock			KSD7-14-10ILDC	
P1	B513400045	Connector, Pin Header	5P		HNC2-2.5P-5DSL	
P2	A513301007	Connector	30 PIN		PS30PAD4TIAI	
P27	G513200101	Connector, Plug	1P		1625-1P-1	
CNP	G513400001	Contact Pin			1854TL	
FCA	A520110060	Flat Cable with Connector		30 PIN, 42mm	L42-30P	
PCB	A511310020	Printed Circuit Board			3101-02B	
	B516100020	Cap, Black			B911	x 10
	A516100025	Cap, Ivory			B201	
	B508201007	Spacer			IP-10	x 11

Figures	Part No.	Description	Type	Remarks
P1	G513400045	Connector Pin Header 5P	HNC2-2.5P5DSL	
P2	A513301010	" 30P	PS30PED4T1PN1	
FCA	A520110060	Flat Cable With Connector 30 PIN 42mm	L42-30P	
P1001	G513200101	Connector Plug 1P	1625-1P-1	
PIN	G513400001	Connector Pin	1854TL	
P.C.B.	A511310310	Printed Circuit Board	3101-40	
	B516100020	Cap Black	B911	x 10
	A516100025	Cap Ivory	B201	
	B508201007	Spacer	IP-10	x 11

Chart Controller (3101-40)

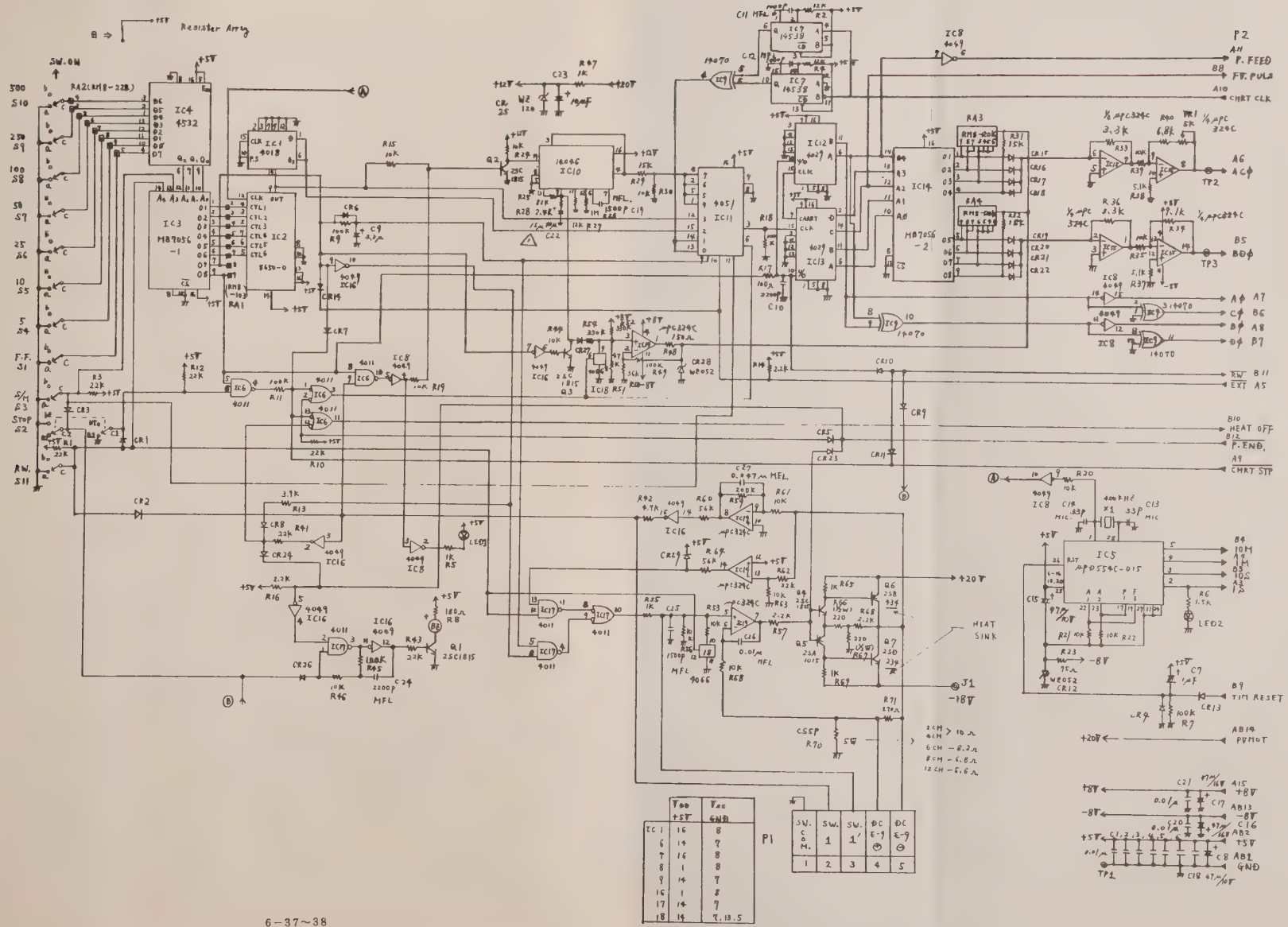


Chart Controller (3101-40) (1/4)

Figures	Part No.	Description	Type	Remarks
IC1	G503300119	IC, CMOS Divide-By-N Counter	TC4018BP	
IC2	A503300100	IC, CMOS Programable-Divider	8650-0	
IC3	A503302051	IC, NMOS Bipolar Memory	MB7056-1	MB7056-1
IC4	A503300118	IC, CMOS Encorder	TC4532BP	
IC5	G503300049	IC, PMOS Micro Computer	μPD554C-015	
IC6	G503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC7	A503301035	IC, CMOS MONO MULTI	HD14538B	
IC8	G503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC9	A503302050	IC, CMOS Quad Exclusive-OR	HD14070B	
IC10	A503302049	IC, CMOS Phase Locked Loop	HD14046B	
IC11	G503300113	IC, CMOS 8CH Multiplexer	TC4051BP	
IC12, 13	G503300107	IC, CMOS Binary U/D Counter	TC4029BP	
IC14	A503302052	IC, NMOS Bipolar Memory	MB7056-2	
IC15	G503301009	IC, Op Amp Quad	μPC324C	
IC16	G503300094	IC, CMOS Hex Inverting Buffer	TC4049BP	
IC17	G503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC18	G503300052	IC, CMOS Quad Bilateral Switch	TC4066BP	
IC19	G503301009	IC, Op Amp Quad	μPC324C	
Q1 ~ 4	G503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q5	G503203016	T, NPN −30V −100mA 200mW	2SA1015, Y	
Q6	G503200007	T, PNP −50V −3A 1.5W	2SB434, O	
Q7	G503200015	T, NPN 50V 3A 1.5W	2SD234, O	
CR1 ~ 11	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR12	G503100060	Di, Si 5.2V 0.5W ±5%	WZ052	
CR13 ~ 24	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR25	G503100006	Di, Si 12V 0.5W ±5%	WZ120	
CR26, 27	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR28	G503100060	Di, Si 5.2V 0.5W ±5%	WZ052	
CR29	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
LED1, 2	A503100080	Di, LED Red I_F = 25mA	TLR102A	
R1	G501810422	R, Metal Film 22K 1/4 ±1%	RN1/4-22KF	
R2	G501810412	R, " 12K 1/4 ±1%	RN1/4-12KF	
R3	G501810422	R, " 22K 1/4 ±1%	RN1/4-22KF	
R4	G501810412	R, " 12K 1/4 ±1%	RN1/4-12KF	
R5	G501810310	R, " 1K 1/4 ±1%	RN1/4-1KF	
R6	G501810315	R, " 1.5K 1/4 ±1%	RN1/4-1.5KF	
R7	G501810510	R, " 100K 1/4 ±1%	RN1/4-100KF	
R8	G501810218	R, " 180 1/4 ±1%	RN1/4-180F	

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Figures	Part No.	Description				Type	Remarks
R9	G501810510	R, Metal Film	100K	1/4	±1%	RN1/4-100KF	
R10	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R11	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R12	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R13	G501810339	R, "	3.9K	1/4	±1%	RN1/4-3.9KF	
R14	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R15	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R16	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R17	G501810210	R, "	100	1/4	±1%	RN1/4-100F	
R18	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R19 ~ 22	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R23	G501810175	R, "	75	1/4	±1%	RN1/4-75F	
R24	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R25	G501810482	R, "	82K	1/4	±1%	RN1/4-82KF	
R26	G501810610	R, "	1M	1/4	±1%	RN1/4-1MF	
R27	G501810412	R, "	12K	1/4	±1%	RN1/4-12KF	
R28	G501810324	R, "	2.4K	1/4	±1%	RN1/4-2.4KF	
R29	G501810415	R, "	15K	1/4	±1%	RN1/4-15KF	
R30	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R31, 32	G501810415	R, "	15K	1/4	±1%	RN1/4-15KF	
R33	G501810333	R, "	3.3K	1/4	±1%	RN1/4-3.3KF	
R34	G501810391	R, "	9.1K	1/4	±1%	RN1/4-9.1KF	
R35	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R36	G501810333	R, "	3.3K	1/4	±1%	RN1/4-3.3KF	
R37, 38	G501810351	R, "	5.1K	1/4	±1%	RN1/4-5.1KF	
R39	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R40	G501810368	R, "	6.8K	1/4	±1%	RN1/4-6.8KF	
R41	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R42	G501810347	R, "	4.7K	1/4	±1%	RN1/4-4.7KF	
R43	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R44	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R45	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R46	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R47	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R48	G501810215	R, "	150	1/4	±1%	RN1/4-150F	
R49	G501810510	R, "	100K	1/4	±1%	RN1/4-100KF	
R50	G501810436	R, "	36K	1/4	±1%	RN1/4-36KF	
R51	G501810447	R, "	47K	1/4	±1%	RN1/4-47KF	
R52	G501810533	R, "	330K	1/4	±1%	RN1/4-330KF	
R53	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R54	G501810533	R, "	330K	1/4	±1%	RN1/4-330KF	
R55	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R56	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R57	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R58	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	

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Figures	Part No.	Description				Type	Remarks
R59	G501810520	R, Metal Film	200K	1/4	±1%	RN1/4-200KF	
R60	G501810456	R, "	56K	1/4	±1%	RN1/4-56KF	
R61	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R62	G501810422	R, "	22K	1/4	±1%	RN1/4-22KF	
R63	G501810410	R, "	10K	1/4	±1%	RN1/4-10KF	
R64	G501810456	R, "	56K	1/4	±1%	RN1/4-56KF	
R65	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R66, 67	A501604703	R, "	220	1/2	±5%	RSF1/2B-220J	
R68	G501810322	R, "	2.2K	1/4	±1%	RN1/4-2.2KF	
R69	G501810310	R, "	1K	1/4	±1%	RN1/4-1KF	
R70	A501609728	R, Wirewound	10	5	±5%	CS5P-10J	For 2CH, 4CH
	A50160729	R, Wirewound	8.2	5	±5%	CS5P-8.2J	For 6CH
	A50160730	R, "	6.8	5	±5%	CS5P-6.8J	For 8CH
	A50160731	R, "	5.6	5	±5%	CS5P-5.6J	For 12CH
R71	G501210227	R, Metal Film	270	1/4	±1%	RN1/4-270F	
RA1	A501003334	Resister Arrey				EXB-P8-8-103J	
RA2	A501003332	Resister Arrey				EXB-P8-8-222J	
RA3, 4	A501003333	Resister Arrey				EXB-P8-8-124J	
VR1	G505103026	R, Trimmer Cermet	5K			GF6P-5K	
C1 ~ 6	G502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C7	G502203013	C, Tantalum	1μ	33WV		CS15EIV010M	
C8	A502102064	C, Electrolytic	47μ	10WV		ECEA1AS470	
C9	G502203003	C, Tantalum	3.3μ	16WV		CS15EIC3R3M	
C10	G502403028	C, Ceramic	2200P	50WV		UFD04SA222J-L2A	
C11, 12	G502303002	C, Myler Film	0.001μ	50WV		MFL-05D1	
C13, 14	A502703021	C, Mica	33P	100WV		Z05-100V33P	
C15	A502102064	C, Electrolytic	47μ	10WV		ECEA1AS470	
C16, 17	A502102029	C, "	47μ	16WV		ECEA1CS470	
C18	G502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C19	A502303019	C, Myler Film	0.0015μ	50WV		MFL-05D15	
C20, 21	G502403007	C, Ceramic	0.01μ	50WV		ULD06-103-L2A	
C22, 23	G502203002	C, Tantalum	10μ	16WV		CS15E1C100M	
C24	G502303001	C, Myler Film	0.0022	50WV		MFL-05D22	
C25	A502303019	C, "	0.0015μ	50WV		MFL-05D15	
C26	G502303004	C, "	0.01μ	50WV		MFL-05S1	
C27	G502303005	C, "	0.047μ	50WV		MFL-05S47	
TP1 ~ 3	B513400027	Check Pin				LC-1-G	
BZ	A519300001	Buzzer				SD161201	
X1	A519105001	X Crystal Oscillator		400kHz		HC-6/UW-400kHz	

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Figures	Part No.	Description	Type	Remarks
S1	A508201013	Switch Push Non-Lock	KSD1-2-ONLDC	
S2, 3	A508213001	Switch Push Lock	KSD2-4-10LLDC	
S4 ~ 10	A508207001	Switch Push Lock	KSD7-14-10ILDC	
S11	A508201013	Switch Push Non-Lock	KSD1-2-ONLDC	
P1	G513400045	Connector Pin Header 5P	HNC2-2.5P5DSL	
P2	A513301010	" 30P	PS30PED4T1PN1	
FCA	A520110060	Flat Cable with Connector 30PIN 42mm	L42-30P	
P1001	G513200101	Connector Plug 1P	1625-1P-1	
PIN	G513400001	Connector Pin	1854TL	
P.C.B.	A511310310	Printed Circuit Board	3101-40	
	B516100020	Cap Black	B911	x10
	A516100025	Cap Ivory	B201	
	B508201007	Spacer	1P-10	x11

Chart Driver

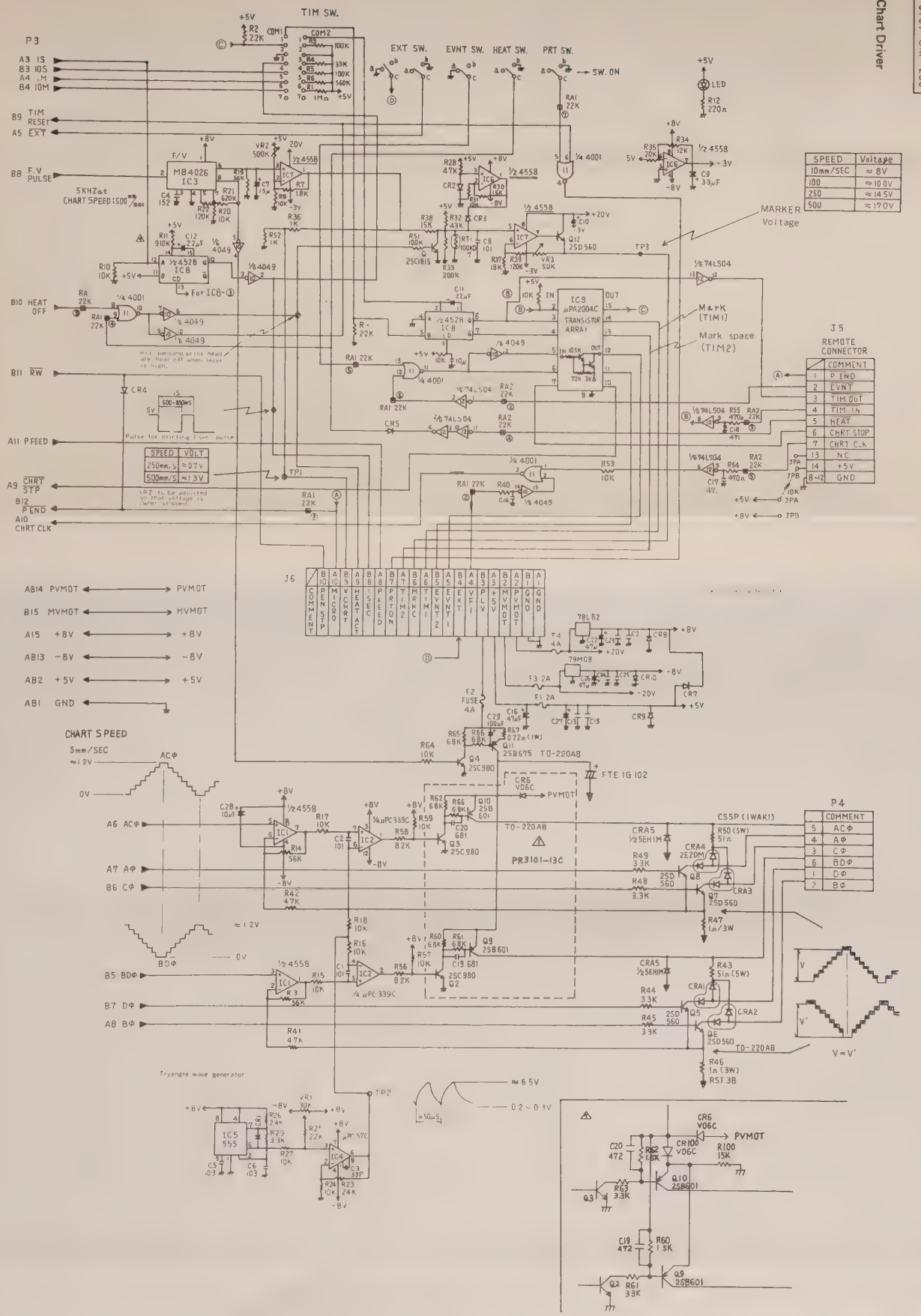


Chart Driver

Figure	Part No.	Description	Type	Remarks
IC1	G503300054	IC, Op Amp	NJM4558D	
IC2	A503300121	IC, Comparator	μPC339C	
IC3	A503300122	IC, F/V Convertor	MB4206	
IC4	A503300123	IC, Op Amp	μPC157C	
IC5	G503300030	IC, Trimmer	NE555	
IC6, 7	G503300054	IC, Op Amp	NJM4558D	
IC8	A503300063	IC, CMOS MONO. MULTI	TC4528BP	
IC9	A503300098	IC, Transister Array	μPA2004C	
IC10	A503300094	IC, CMOS Inverting Buffer	TC4049BP	
IC11	A503300124	IC, CMOS 2 In-Nor	TC4001BP	
IC12	A503300125	IC, TTL Inverter	SN74LS04	
IC13	A503300126	IC, Voltage Regulator	μA79M08	
IC14	A503300127	IC, Voltage Regulator	μA78L082AWC	
Q1	G503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	
Q2~4	A503203017	T, NPN 70V 100mA 400mW	2SC980, O	
Q5~8	A503200028	T, NPN 100V 5A 1.5W	2SD560, L	
Q9, 10	A503203018	T, PNP –100V –5A 1.5W	2SB601, L	
Q11	A503203020	T, PNP –60V –7A 3W	2SB675, OL	
CR1~5	G503100020	Di, Si V_R = 30V I_F = 100mA	IS953	
CR6	G503103004	Di, Si V_R = 200V I_F = 4A	U06C	
CR7~10	G503100020	Di, Si V_R = 200V I_F = 1.1A	V06C	
CRA1~4	A503100063	Di, Si Diode Module	2E2DM	
CRA5	A503100066	Di, Si Diode Module	5EH2M	
R1	G501203738	R, Solid 1M 1/4 ±5%	RC1/4-1MJ	
R2	G501203719	R, Solid 2.2K 1/4 ±5%	RC1/4-2.2KJ	
R3	G501203731	R, Solid 100K 1/4 ±5%	RC1/4-100KJ	
R4	G501203745	R, Solid 33K 1/4 ±5%	RC1/4-33KJ	
R5	G501203731	R, Solid 100K 1/4 ±5%	RC1/4-100KJ	
R6	G501203761	R, Solid 560K 1/4 ±5%	RC1/4-560KJ	
R7	G501303754	R, Metal Film 1.8K 1/4 ±5%	RNE1/4-1.8KJ	
R8	G501303708	R, Metal Film 10K 1/4 ±5%	RNE1/4-10KJ	
R9	G501203727	R, Solid 22K 1/4 ±5%	RC1/4-22KJ	
R10	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	
R11	G501203773	R, Solid 910K 1/4 ±5%	RC1/4-910KJ	
R12	G501203709	R, Solid 220 1/4 ±5%	RC1/4-220J	
R13, 14	G501203730	R, Solid 56K 1/4 ±5%	RC1/4-56KJ	
R15~18	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	
R19	G501303709	R, Metal Film 56K 1/4 ±5%	RNE1/4-56KJ	
R20	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	
R21	G501203774	R, Solid 620K 1/4 ±5%	RC1/4-620KJ	
R22	G501203775	R, Solid 120K 1/4 ±5%	RC1/4-120KJ	

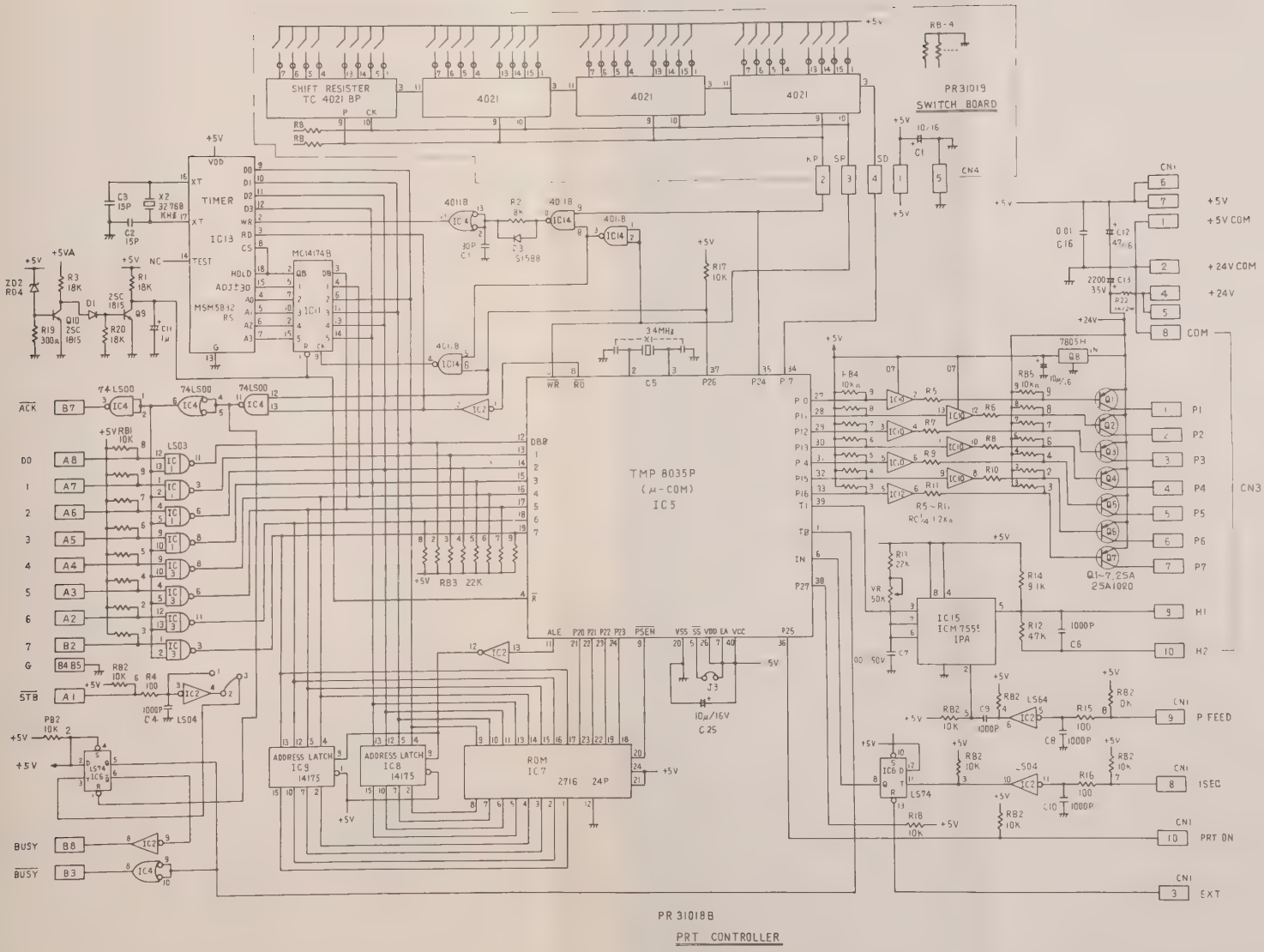
Figure	Part No.	Description				Type	Remarks
R23	G501303732	R, Metal Film	24K	1/4	±5%	RNE1/4-24KJ	
R24	G501303708	R, Metal Film	10K	1/4	±5%	RNE1/4-10KJ	
R25	G501303776	R, Metal Film	22K	1/4	±5%	RNE1/4-22KJ	
R26	G501303740	R, Metal Film	2.4K	1/4	±5%	RNE1/4-2.4KJ	
R27	G501303708	R, Metal Film	10K	1/4	±5%	RNE1/4-10KJ	
R28	G501303733	R, Metal Film	4.7K	1/4	±5%	RNE1/4-4.7KJ	
R29	G501303774	R, Metal Film	3.3K	1/4	±5%	RNE1/4-3.3KJ	
R30	G501303710	R, Metal Film	15K	1/4	±5%	RNE1/4-15KJ	
R31	G501303708	R, Metal Film	10K	1/4	±5%	RNE1/4-10KJ	
R32	G501303709	R, Metal Film	56K	1/4	±5%	RNE1/4-56KJ	
R33	G501303748	R, Metal Film	200K	1/4	±5%	RNE1/4-200KJ	
R34	G501203741	R, Solid	12K	1/4	±5%	RC1/4-12KJ	
R35	G501203764	R, Solid	20K	1/4	±5%	RC1/4-20KJ	
R36	G501303717	R, Metal Film	1K	1/4	±5%	RNE1/4-1KJ	
R37	G501303746	R, Metal Film	18K	1/4	±5%	RNE1/4-18KJ	
R38	G501303710	R, Metal Film	15K	1/4	±5%	RNE1/4-15KJ	
R39	G501303735	R, Metal Film	120K	1/4	±5%	RNE1/4-120KJ	
R40~42	G501203722	R, Solid	4.7K	1/4	±5%	RC1/4-4.7KJ	
R43	A501609724	R, Wirewound	51	5	±5%	CS5P-51J	
R44, 45	G501203721	R, Solid	3.3K	1/4	±5%	RC1/4-3.3KJ	
R46, 47	A501609723	R, Metal Film	1	3	±5%	RSF3B1J	
R48, 49	G501203721	R, Solid	3.3K	1/4	±5%	RC1/4-3.3KJ	
R50	A501609724	R, Wirewound	51	5	±5%	CS5P-51J	
R51	G501203731	R, Solid	100K	1/4	±5%	RC1/4-100KJ	
R52	G501303717	R, Metal Film	1K	1/4	±5%	RNE1/4-1KJ	
R53	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R54, 55	G501203712	R, Solid	470	1/4	±5%	RC1/4-470J	
R56	G501203776	R, Solid	8.2K	1/4	±5%	RC1/4-8.2KJ	
R57	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R58	G501203776	R, Solid	8.2K	1/4	±5%	RC1/4-8.2KJ	
R59, 64	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
R60~63 R65, 66	G501203724	R, Solid	6.8K	1/4	±5%	RC1/4-6.8KJ	
R67	A501605710	R, Metal Film	0.22	1	±5%	RSF18-0.22J	
R68~70	G501203725	R, Solid	10K	1/4	±5%	RC1/4-10KJ	
VR1	A504207047	R, Trimmer, Cermet	20K			TM10KPV-20K	
VR2	A505103029	R, Trimmer, Cermet	500K			RJ6P-500K	
VR3	B504207038	R, Trimmer, Cermet	50K			TM10KPV-50K	
RA1	B501002811	Resister Array			±10%	RKC1/8-B8-22K	
RA2	B501002814	Resister Array			±10%	RKC1/8-B4-22K	
RT1	G503103012	Thermister B-Class	100K			100KD-7	

Figure	Part No.	Description			Type	Remarks
C1, 2	G502403029	C, Ceramic	100P	50WV	UFD04SA101J-L0B	
C3	G502403034	C, Ceramic	33P	50WV	RAU04SL330KL05AE	
C4	G502303019	C, Myler Film	1500P	50WV	MFL-05D15	
C5, 6	G502303004	C, Myler Film	0.01μ	50WV	MFL-05SI	
C7	A502203024	C, Tantalum	1.5μ	16WV	CS15EICIR5M	
C8	A502403029	C, Ceramic	100P	50WV	UFD04SA101J-L0B	
C9	G502203003	C, Tantalum	3.3μ	16WV	CS15EIC3R3M	
C10	G502203013	C, Tantalum	1μ	35WV	CS15EIV010M	
C11	G502203017	C, Tantalum	22μ	16WV	CS15EIC220M	
C12	G502203003	C, Tantalum	3.3μ	16WV	CS15EIC3R3M	
C13	G502403007	C, Ceramic	0.01μ	50WV	UFD06-103-L2A	
C14	G502403034	C, Ceramic	220P	50WV	UFD04SA221J-L0B	
C15	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C16	G502103025	C, Electroric	47μ	10WV	SM10VB-47	
C17, 18	G502403035	C, Ceramic	220P	50WV	UFD04SA221J-L0B	
C19, 20	G502403036	C, Ceramic	680P	50WV	UFD04SA681J-L0B	
C21	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C22	G502103024	C, Electric	47μ	16WV	SM16VB-47	
C23~25	G502403007	C, Ceramic	0.01μ	50WV	ULD06-103-L2A	
C26	G502103024	C, Electoric	47μ	16WV	SM16VB-47	
C27, 28	G502203002	C, Tantalum	10μ	16WV	CS15EIC100M	
C29	A502103026	C, Electoric	100μ	6.3WV	SM6.3VB100	
FTE	A502403037	C, Electoric	1000μ	50WV	FTE1G102	
SW12, 13	A508201006	Switch Push Lock			KSD1-2-0LLDC	
SW14	A508201010	Switch Push Non-Lock			KSD1-2-0NLDC	
SW15	A508201006	Switch Push Lock			KSD1-2-0LLDC	
SW16	A508101015	Switch Rotary			DSR2-6	
F1	A512300010	Fuse	2A		275002	
F2	A512300025	Fuse	4A		275004	
F3	A512300010	Fuse	2A		275002	
F4	A512300025	Fuse	4A		275004	
TP1~3	B513400027	Check Pin			LC-1-G	
LED1	B512100018	Di, LED RED	I_F = 30mA		SLB26 UR	
P4	B513400046	Connector	6 PIN		HNC2-2.5P-6DSL	
P3	A513301007	Connector	30 PIN		PS30PAD4T1A1	
J5	A513100344	Connector	14 PIN		57-40140D39	
J6	A513300604	Connector	10P x 2		225J21021-487	

Figure	Part No.	Description	Type	Remarks
PCB	A511310130	Printed Circuit Board	3101-13B	
	B516100020	Cap, Black	B911	x 4
	B508201007	Spacer	1P-10	x 4
	B516100016	Knob, ϕ10mm, Black	021-222	For SW16
	B516100018	Cap, ϕ10mm, Black	040-162	For SW16

PR3101-13B			PR3101-13C		
Figure	Part No.	Type	Figure	Part No.	Type
R43	A501609724	CS5P-51J	R43		CS10P-51J
R50	"	"	R50		"
R60	G501203724	RC1/4-6.8KJ	R60	G501810315	RN1/4-1.5KF
R61	"		R61	G501810333	RN1/4-3.3KF
R62	"		R62	G501810315	RN1/4-1.5KF
R63	"		R63	G501810333	RN1/4-3.3KF
			R100	G501810415	RN1/4-15KF
			CR100	B503103004	U06C
C19	G502403036	UFD04-SA681J-L0B	C19	G502303007	MFL-05D47
C20	"	"	C20	"	"
IC14	A503300127	μA78L082AWX	IC14	A503301064	UPC78L08

Printer Unit

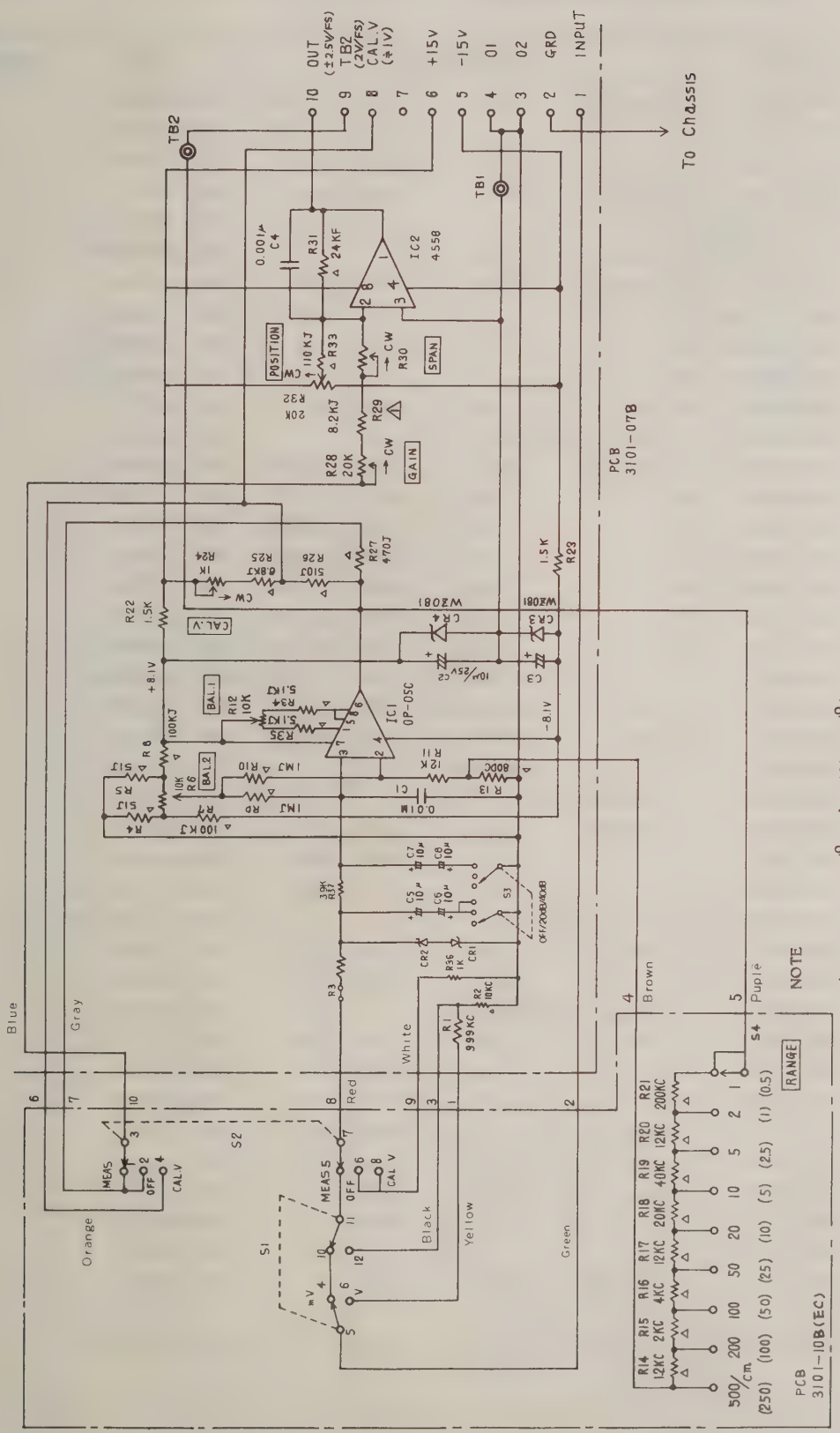


Printer Unit

Figure	Part No.	Description	Type	Remarks
IC1	A503300135	IC, TTL Quad 2 In-Nand O.C.	SN74LS03	
IC2	A503300125	IC, TTL Hex Inverter	SN74LS04	
IC3	A503300135	IC, TTL Quad 2 In-Nand O.C.	SN74LS03	
IC4	A503300138	IC, TTL Quad 2 In-Nand	SN74LS00	
IC5	A503300132	IC, NMOS Micro Computer	TMP8035P	
IC6	A503300137	IC, TTL Dual D-F.F.	SN74LS74	
IC7	A503300133	IC, NMOS EP ROM	MB8516	
IC8, 9	A503300140	IC, CMOS Quad D Flip Flop	TC40174BP	
IC10	A503300136	IC, TTL Hex Buffer O.C.	SN7407	
IC11	A503300140	IC, CMOS HEX D Flip Flop	TC40174BP	
IC12	A503300136	IC, TTL Hex Buffer O.C.	SN7407	
IC13	A503300134	IC, CMOS Real Time Clock	MSM5832RS	
IC14	A503300062	IC, CMOS Quad 2 In-Nand	TC4011BP	
IC15	A503300142	IC, CMOS Timer	ICM7555	
Q8	A503300128	IC, Voltage Regulator	μPC7805H	
Q1~7	A503203019	T, PNP –50V –2A 900mW	2SA1020, Y	
Q9, 10	G503203014	T, NPN 30V 100mA 200mW	2SC1815, Y	2SC373
R1~3	G501203758	R, Solid 18K 1/4 ±5%	RC1/4-18KJ	
R4	G501203707	R, Solid 100 1/4 ±5%	RC1/4-100J	
R5~11	G501203717	R, Solid 1.2K 1/4 ±5%	RC1/4-1.2KJ	
R12	G501203751	R, Solid 47K 1/4 ±5%	RC1/4-47KJ	
R13	G501203727	R, Solid 22K 1/4 ±5%	RC1/4-22KJ	
R14	G501203781	R, Solid 9.1K 1/4 ±5%	RC1/4-9.1KJ	
R15, 16	G501203707	R, Solid 100 1/4 ±5%	RC1/4-100J	
R17, 18	G501203725	R, Solid 10K 1/4 ±5%	RC1/4-10KJ	
R19	G501203779	R, Solid 300 1/4 ±5%	RC1/4-300J	
R20	G501203758	R, Solid 18K 1/4 ±5%	RC1/4-18KJ	
R22	G501606706	R, Metal Film 1 2 ±5%	RFS2B-1J	
RB1, 2	B501002813	Resister Arrey 10K x 8 ±10%	RM8-103J	
RB3	B501002811	Resister Arrey 22K x 8 ±10%	RM8-223J	
RB4, 5	B501002813	Resister Arrey 10K x 8 ±10%	RM8-103J	
D1	G503100020	Di, Si V_R = 30V I_F = 0.1A	IS953	
ZD2	A503100068	Di, Zener 4.0V 0.5W ±5%	RD4A	
D3	G503100020	Di, Si V_R = 30V I_F = 0.1A	IS953	
VR1	A505103027	R, Trimmer Cermet 50K	RJ6P-50K	
C1	G502403034	C, Ceramic 33P 50WV	RAU04SL330L05AE	
C2, 3	A502703007	C, Mica 15P 100WV	Z05-100V15P	
C4	G502403015	C, Ceramic 1000P 50WV	ULD06-102	
C5				
C6	G502403015	C, Ceramic 1000P 50WV	ULD06-102	

Figure	Part No.	Description	Type	Remarks
C7	G502303004	C, Myler Film 0.01 50WV	MFL-0.5SI	
C8	G502403015	C, Ceramic 1000P 50WV	ULD06-102	
C9	G502303002	C, Myler Film 1000P 50WV	MFL-0.5DI	
C10	G502403015	C, Ceramic 1000P 50WV	ULD06-102	
C11	G502203013	C, Tantalum 1μ 35WV	CS15EIV010M	
C12	A502101023	C, Electrolytic 47μ 16WV	SL16VB-47	
C13	A502101024	C, Electrolytic 1000μ 35WV	SL35T-1000CI	
C14	G502203002	C, Tantalum 10μ 15WV	CS15EIC100M	
C15~24	G502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
X1	B502802004	Ceramic Osillator 3.40MHz	CSA-3.40MHz	Pair
X2	B502802006	Crystal Osillator 32.768KHz		
CN4	A513400072	Connector, Receptacle 10P	HNC2-2.5S-10	
CN5	A513400050	Connector, 16 PIN-Plug	FCN-365P016-AG	
	A513400052	Plate, Connector Holder and Cover	FCN 360A2 and FCN-260C016B	
	A513400051	Connector, 16 PIN-Jack	FCN-261J016-AG	
	B513400054	Connector, Pin Header 5P	HNC2-2.5P-5DSL	
	B513400044	Connector, Receptacle 5P	HNC2-2.5S-5	
	B513400037	Contact Pin	HNC-2.5S-A	x 5
PCB	A511310080	Printed Circuit Board	3101-08B	
	A513400056	IC-Socket 18 PIN	DILB-P-8J, 18P	
	A513400055	IC-Socket 24 PIN	DILB-P-8J, 24P	
C25	G502203002	C, Tantalum 10μ 15WV	CS15EIC100M	
SW1~8	A508401012	SW. Thumb Wheel, Decimal	A7MA-206-P2	
	A508401015	SW. Spacer	A7M-2PA	
	A508401013	SW. Hook	A7M-2M	
IC1~4	A503300131	IC, CMOS Shift Registor	TC4021BP	
RB1~8	G501102745	Resistor Array	RKC1/8-B4-22KK	
C1	G502203002	C, Tantalum 10μ 15WV	CS15EIC100M	
C2	G502403007	C, Ceramic 0.01μ 50WV	ULD06-103-L2A	
PCB	A511310090	Printed Circuit Board	3101-09	
	A597110001	Print Head 24V 1A	EUX-TP703AT	
	A513300612	Connector 10P x 2	225J21021-488	

Pre Amplifier Type H (AH3101), DH (AH3102)



NOTE

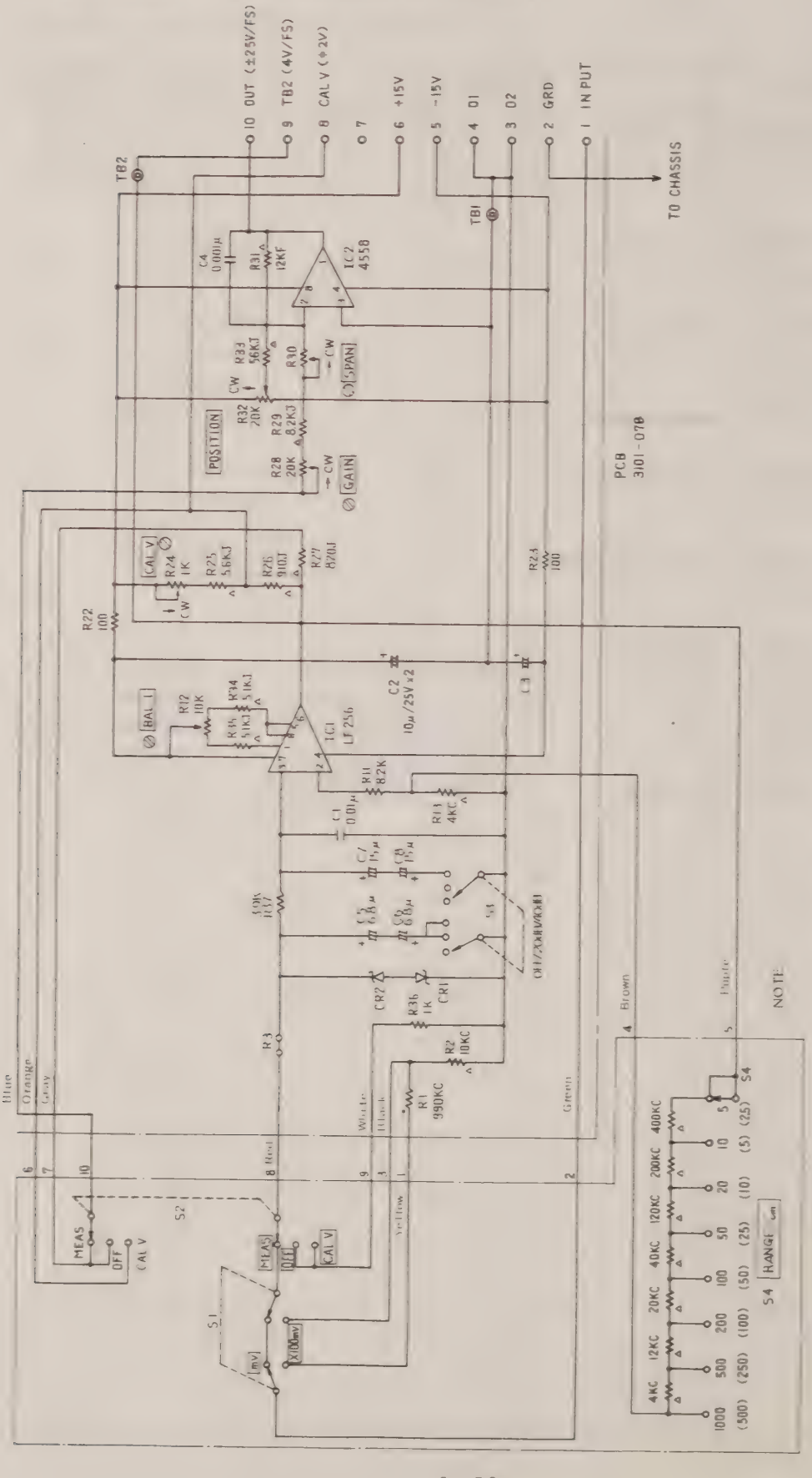
1) • is 25 ppm/°C. △ is 100 ppm/°C.
2) Trimmer R30 used only in export models.
   It is short-circuited in the standard models.
3) Ranges for model AH3102 shown within brackets.

Pre Amplifier Type H (AH3101), DH (AH3102)

Figure	Part No.	Description				Type	Remarks
R1	G501503302	R, Metal Film	999K	1/2W	±0.25%	RN65E999KC	
R2	G501303301	R, "	1K	1/4W	±0.25%	RNE1/4-1KC	
R3	G501810362	R, "	6.2K	1/4W	±1%	RN1/4-6.2KF	
R4	G501303753	R, Metal Film	51	1/4W	±5%	RNE1/4-51J	
R5	G501303753	R, "	"	"	"	RNE1/4-51J	
R6	G504207021	R, Trimme Cermet	10K			TM10KPH-10K	
R7	G501303771	R, Metal Film	100K	1/4W	±5%	RNE1/4-100KJ	
R8	G501303771	R, "	"	"	"	RNE1/4-100KJ	
R9	501304704	R, "	1M	1/2W	±5%	RNE1/2-1MJ	
R10	501304704	R, "	"	"	"	RNE1/2-1MJ	
R11	G501203741	R, Solid	12K	1/4W	±5%	RC1/4-12KJ	
R12	504207048	R, Trimmer Cermet	10K			TM10KPH-10K	
R13	501303315	R, Metal Film	800	1/4W	±0.25%	RNE1/4-800C	
R14	501303316	R, "	1.2K	1/4W	±0.25%	RNE1/4-1.2KC	
R15	501303317	R, "	2K	1/4W	±0.25%	RNE1/4-2KC	
R16	501303308	R, "	4K	1/4W	±0.25%	RNE1/4-4KC	
R17	501303309	R, "	12K	1/4W	±0.25%	RNE1/4-12KC	
R18	501303310	R, "	20K	1/4W	±0.25%	RNE1/4-20KC	
R19	501303311	R, "	40K	1/4W	±0.25%	RNE1/4-40KC	
R20	501303312	R, "	120K	1/4W	±0.25%	RNE1/4-120KC	
R21	501303313	R, "	200K	1/4W	±0.25%	RNE1/4-200KC	
R22	G501203718	R, Solid	1.5K	1/4W	±5%	RC1/4-1.5KJ	
R23	G501203718	R, "	"	"	"	RC1/4-1.5KJ	
R24	504207049	R, Trimmer Cermet	1K			TM10KPH-1K	
R25	G501303713	R, Metal Film	6.8K	1/4W	±5%	RNE1/4-6.8KJ	
R26	G501303731	R, "	510	1/4W	±5%	RNE1/4-510J	
R27	G501303704	R, "	470	1/4W	±5%	RNE1/4-470J	
R28	504103015	R, Variable Carbon	20K			RV16YP20SB20K	
R29	G501303703	R, Metal Film	8.2K	1/4W	±5%	RNE1/4-8.2KJ	
R31	G501303511	R, "	24K	1/4W	±1%	RNE1/4-24KF	
R32	504103015	R, Variable Carbon	20K			RV16YP20SB20K	
R33	B501303767	R, Metal Film	110K	1/4W	±5%	RNE1/4-110KJ	
R34	G501303758	R, "	5.1K	1/4W	±5%	RNE1/4-5.1K	
R35	G501303758	R, "	5.1K	"	"	RNE1/4-5.1K	
R36	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R37	G501810362	R, Metal Film	6.2K	1/4W	±1%	RN1/4-6.2KF	
C1	G502303004	C, Myler Film	0.01μ	50WV		MFL-05SI	
C2	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C3	502103023	C, "	"	"		AM25VB-10	
C4	G502303002	C, Myler Film	0.001μ	50WV		MFL-05DI	
C5	502204004	C, Tantalum	10μ	16WV		CS15EIC100M1S-A	
C6	"	C, "	"	"		"	
C7	"	C, "	"	"		"	
C8	"	C, "	"	"		"	

Figure	Part No.	Description	Type	Remarks
CR1	G503100035	Di, Zener 6.5V 0.5W ±5%		WZ065
CR2	G503100035	Di, 〃 〃 〃 〃		WZ065
CR3	G503100007	Di, 〃 8.1V 〃 〃		WZ081
IC1	A503300006	IC, Op-Amp	OP-05C	
IC2	A503300054	IC, 〃 Dual	NJM4558D	
S1	508304008	Switch, Slide	SSA042L12	
S2	G508304002	〃	SSA043L12	
S3	G508304003	〃	SSA043L06	
S4	507101108	Switch, Rotary 1-1-9	SRM1019-15R-P	
TB1	B513400027	Test Terminal	LC-1-G	
TB2	B513400027	〃	LC-1-G	
PCB	511310220	Printed Circuit Board	3101-07B	
PCB	511310301	〃	3101-10B (EC)	
	067117110	Spacer		Position
	516100016	Knob φ10mm, Black, with Line	021-222	Position
	516100028	〃 φ14.5mm, Black, with Line	023-342	Range
	516100018	Cap φ10mm, Black, with Line	040-162	Position
	516100029	〃 φ14.5mm, Black, with Line	040-362	Range
	516100030	Nut Cover φ14.5mm, Black, with Line	044-322	〃

Pre Amplifier Type L (AL3101), DL (AL3102)

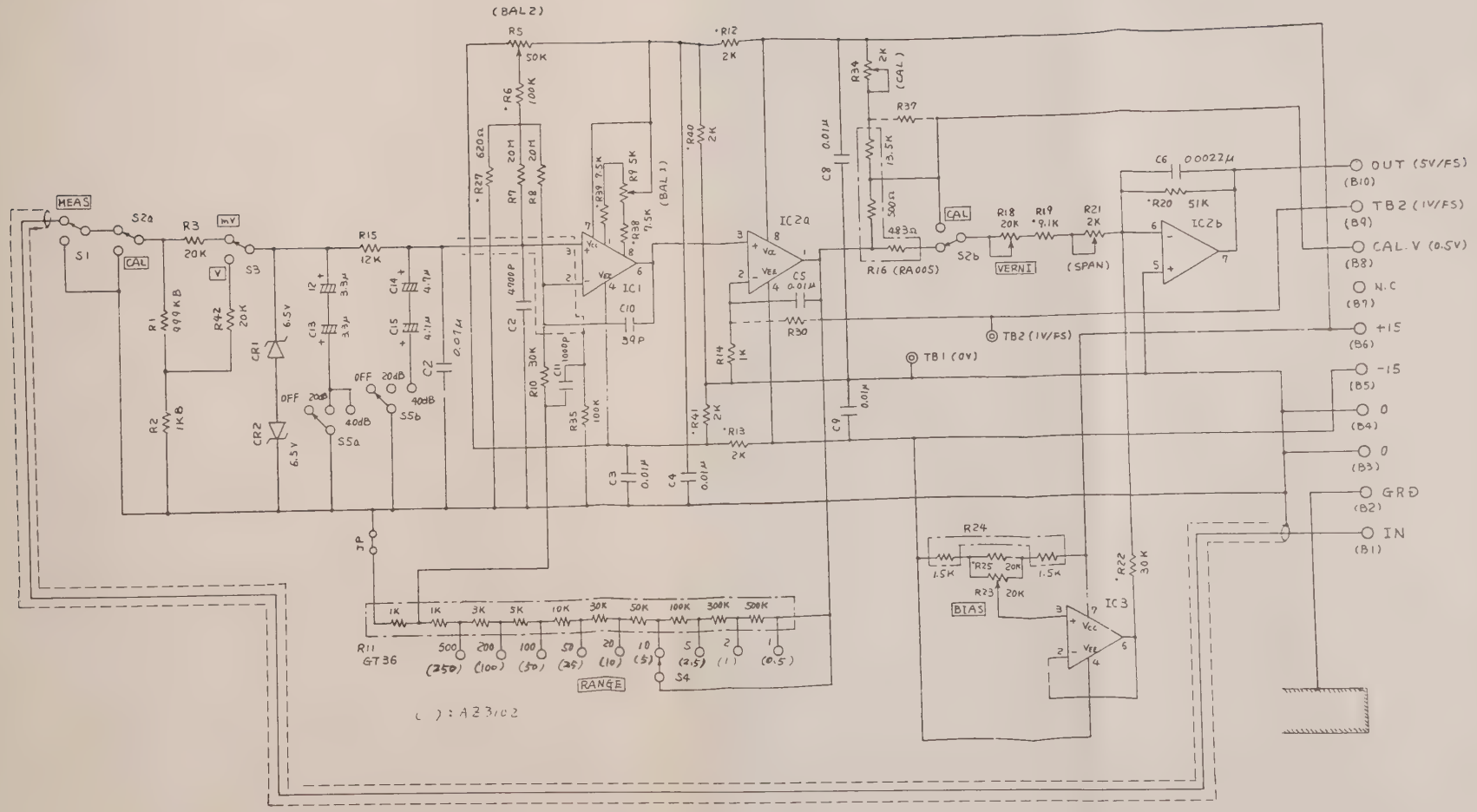


Pre Amplifier Type L (AL3101), DL (AL3102)

Figure	Part No.	Description				Type	Remarks
R1	G501503301	R, Metal Film	990K	1/2W	±0.25%	RN65E990KC	
R2	501303307	R, "	10K	1/4W	±0.25%	RNE1/4-10KC	
R3							SHORT
R11	501203776	R, Solid	8.2K	1/4W	±5%	RC1/4-8.2KJ	
R12	G504207021	R, Trimmer Cermet	10K			TM10KPH-10K	
R13	501303308	R, Metal Film	4K	1/4W	±0.25%	RNE1/4-4KC	
R14	501303308	R, "	"	"	"	RNE1/4-4KC	
R15	501303309	R, "	12K	1/4W	±0.25%	RNE1/4-12KC	
R16	501303310	R, "	20K	1/4W	±0.25%	RNE1/4-20KC	
R17	501303311	R, "	40K	1/4W	±0.25%	RNE1/4-40KC	
R18	501303312	R, "	120K	1/4W	±0.25%	RNE1/4-120KC	
R19	501303313	R, "	200K	1/4W	±0.25%	RNE1/4-200KC	
R20	501303314	R, "	400K	1/4W	±0.25%	RNE1/4-400KC	
R22	G501203707	R, Solid Film	100	1/4W	±5%	RC1/4-100 J	
R23	G501203707	R, "	"	"	"	RC1/4-100 J	
R24	504207049	R, Trimmer Cermet	1K			TM10KPH-1K	
R25	G501303723	R, Metal Film	5.6K	1/4W	±5%	RNE1/4-5.6KJ	
R26	501303795	R, "	910K	1/4W	±5%	RNE1/4-910J	
R27	G501303728	R, "	820K	1/4W	±5%	RNE1/4-820J	
R28	504103015	R, Variable Carbon	20K			RV16YP20SB20K	
R29	501303703	R, Metal Film	8.2K	1/4W	±5%	RNE1/4-8.2KJ	
R31	501303567	R, "	12K	1/4W	±1%	RNE1/4-12KF	
R32	504103015	R, Variable Carbon	20K			RV16YP20SB20K	
R33	G501303709	R, Metal Film	56K	1/4W	±5%	RNE1/4-56KJ	
R34	G501303758	R, "	5.1K	1/4W	±5%	RNE1/4-5.1KJ	
R35	G501303758	R, "	5.1K	1/4W	±5%	RNE1/4-5.1KJ	
R36	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ	
R37	G501810339	R, Metal Film	3.9K	1/4W	±1%	RN1/4-3.9KF	
C1	G502303004	C, Myler Film	0.01μ	50WV		MFL-05SI	
C2	502103023	C, Electrolytic	10μ	25WV		SM25VB-10	
C3	502103023	C, "	"	"		SM25VB-10	
C4	G502303002	C, Myler Film	0.001μ	50WV		MFL-05DI	
C5	502204001	C, Tantalum	6.8μ	16WV		CS15EIC6R8M1S-A	
C6	"	C, "	"	"		"	
C7	502204005	C, "	15μ	"		CS15EIC150M1S-A	
C8	"	C, "	"	"		"	
CR1	G503100005	Di, Zener	13V	0.5W	±5%	WZ130	
CR2	G503100005	Di, Zener	"	"	"	WZ130	
IC1	503300130	IC, Op-Amp	FET-Top			LF256	
IC2	A503300054	IC, "	Dual			NJM4558D	
S1	508304008	Switch, Slide				SSA042L12	
S2	G508304002	"				SSA043L12	
S4		Switch, Rotary	1-1-8			M1018-15R-P	

Figure	Part No.	Description	Type	Remarks
TB1	B513400027	Test Terminal	LC-1-G	
TB2	B513400027	"	LC-1-G	
PCB	511310220	Printed Circuit Board	3101-07B	
PCB	511310301	"	3101-10B(EC)	
	067117110	Spacer		Position
	516100016	Knob, ϕ10mm, Black, with Line	021-222	Position
	516100028	" ϕ14.5mm, Black, with Line	023-342	Range
	516100018	Cap, ϕ10mm, Black, with Line	040-162	Position
	516100029	" ϕ14.5mm, Black, with Line	044-362	Range
	516100030	Nut Cover ϕ14.5mm, Black, with Line	044-322	Range

Pre Amplifier Type Z (AZ3101), DZ(AZ3102)



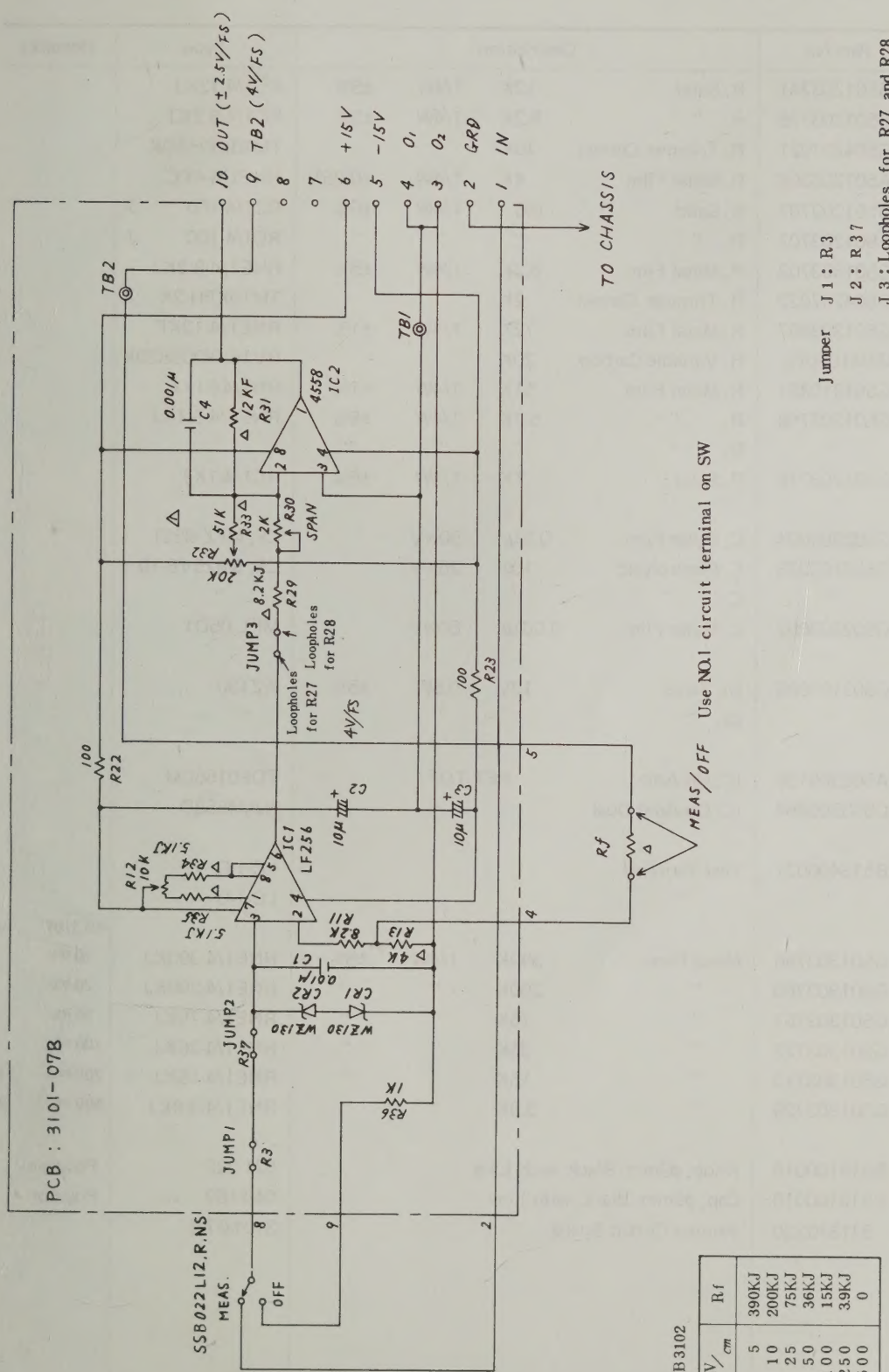
Preamplifier Type Z (AX3101), DZ (AZ3102) (1/2)

Figure	Part No.	Description	Type	Remarks
IC1	503302039	IC, Op-Amp	OP-05E-B	
IC2	503300054	IC, " Dual	μPC4558C	
IC3	503300023	IC, "	μPC741C	
CR1	503100035	Di, Zener 6.5V 5% 0.5W	WZ065	
CR2	"	Di, " " " "	"	
R1	501503204	R, Metal Film 999K 0.1% 1/4W 50ppm	RN65E999KB	
R2	501502202	R, " 1K " " "	RN60E1KB	
R3	501810420	R, " 20K 1% " 100ppm	RN1/4-20KF	
R5	505103024	R, Trimmer Cermet 50K	GF6X-50K	For BAL.
R6	501443651	R, Metal Film 100K 1% 1/4W 50ppm	RP44C100KF	
R7	501502216	R, " 20M 10% 1/8W 100ppm	RH1/8HVS20MK	
R8	"	R, " " " " "	"	
R9	505101026	R, Trimmer Cermet 5K	RJ20P-5K	For BAL.
R10	501810430	R, Metal Film 30K 1% 1/4W 100ppm	RN1/4-30KF	
R11	501003307	R, Array	GT36	
R12	501443631	R, Metal Film 2K 1% 1/4W 50ppm	RP44C2KF	
R13	"	R, " " " " "	"	
R14	501810310	R, " 1K " " 100ppm	RN1/4-1KF	
R15	501810412	R, " 12K " " "	RN1/4-12KF	
R16	501002809	R, Array	RA005	
R18	504105006	R, Trimmer Cermet 20K	GFP161-20SB20K	For VRNI.
R19	501443608	R, Metal Film 9.1K 1% 1/4W 50ppm	RP44C9.1KF	
R20	501443656	R, " 51K " " "	RP44C51KF	
R21	505103009	R, Trimmer Cermet 2K	GF6X-2K	For SPAN.
R22	501443642	R, Metal Film 30K 1% 1/4W 50ppm	RP44C30KF	
R23	504105007	R, Trimmer Cermet 20K	M1305-20K	For POS.
R24	501003309	R, Array	RA940	
R25	501443614	R, Metal Film 20K 1% 1/4W 50ppm	RP44C20KF	
R27	501443602	R, " 620 " " "	RP44C620KF	
R34	505103009	R, Trimmer Cermet 2K	GF6X-2K	For CAL.
R35	501810510	R, Metal Film 100K 1% 1/4W 100ppm	RN1/4-100KF	
R38	501443603	R, " 7.5K " " 50ppm	RP44C7.5KF	
R39	"	R, " " " " "	"	
R40	501443631	R, " 2K " " "	RP44C2KF	
R41	"	R, " " " " "	"	
R42	501443614	R, " 20K " " "	RP44C20KF	

Preamplifier Type Z (AZ3101), DZ (AX3102) (2/2)

Figure	Part No.	Description			Type	Remarks
C2	502303004	C, Myler Film	0.001μ	50WV	MFL05D1	
C3	502403007	C, Ceramic	10000P	"	ULD06-103-L2A	
C4	"	C, "	"	"	"	
C5	502303004	C, Myler Film	0.01μ	"	MFL05S1	
C6	502303001	C, "	0.022μ	"	MFL05S22	
C8	502403007	C, Ceramic	10000p	"	UFD06-103-L2A	
C9	"	C, "	"	"	"	
C10	502403008	C, "	39p	"	USD04SL390K-K2J	
C11	502303002	C, Myler Film	0.001μ	"	MFL05D1	
C12	502204003	C, Tantalum	3.3μ	16WV	CS15E1C3R3MIS-A	
C13	502204003	C, "	3.3μ	"	"	
C14	502204002	C, "	4.7μ	"	CS15E1C4R7MIS-A	
C15	"	C, "	"	"	"	
S1	508301001	Switch Slide	1-2		J-S4036#01-W	For MEAS
S2	508302012	"	2-2		J-S5089#01-W	For CAL
S3	508301001	"	1-2		J-S4036#01-W	For mv.v
S4	507111108	Switch Rotary	1-1-9		J-R2000	For RANGE
S5	508304003	Switch Slide	4-3		SSA043L06	For Filt
PCB	511400080	Printed Circuit Board			PR4000-06B	

Pre-Amplifier Type AB3101, AB3102



AB3101 AB3102

mV/cm	mV/cm	Rf
10	5	390KJ
20	10	200KJ
50	25	75KJ
100	50	36KJ
200	100	15KJ
500	250	39KJ
1000	500	0

Pre-Amplifier Type AB3101, AB3102

Figure	Part No.	Description				Type	Remarks	
R3	G501203741	R, Solid	12K	1/4W	±5%	RC1/4-12KJ		
R11	G501203776	R, "	8.2K	1/4W	±5%	RC1/4-8.2KJ		
R12	G504207021	R, Trimmer Cermet	10K			TM10KPH-10K		
R13	A501303308	R, Metal Film	4K	1/4W	±0.25%	RNE1/4-4KC		
R22	G501203707	R, Solid	100	1/4W	±5%	RC1/4-100 J		
R23	G501203707	R, "	"	"	"	RC1/4-100 J		
R29	G501303703	R, Metal Film	8.2K	1/4W	±5%	RNE1/4-8.2KJ		
R30	G504207022	R, Trimmer Cermet	2K			TM10KPH-2K		
R31	G501303567	R, Metal Film	12K	1/4W	±1%	RNE1/4-12KF		
R32	A504103015	R, Variable Carbon	20K			RV16YP20SB20K		
R33	G501810451	R, Metal Film	51K	1/4W	±1%	RN1/4-51KF		
R34	G501303758	R, "	5.1K	1/4W	±5%	RNE1/4-5.1KJ		
R35	"	R, "	"	"	"	"		
R36	G501203716	R, Solid	1K	1/4W	±5%	RC1/4-1KJ		
C1	G502303004	C, Myler Film	0.01μ	50wV		CF, MFL-05S1		
C2	G502103023	C, Electrolytic	10μ	25wV		CE, SM25VB-10		
C3	"	C, "	"	"		"		
C4	G502303002	C, Myler Film	0.001μ	50wV		MFL-05D1		
CR1	G503100005	Di, Zener	13V	0.5W	±5%	WZ130		
CR2	"	Di, "	"	"	"	"		
IC1	A503300130	IC, Op-Amp	FET-TOP			TDE0156CM		
IC2	G503300054	IC, Op-Amp Dual				NJM4558D		
TB1	B513400027	Test Terminal				LC-1-G		
TB2	"	"				LC-1-G		
							AB3101	AB3102
Rf	G501303796	Metal Film	390K	1/4W	±5%	RNE1/4-390KJ	10 mV	5 mV
"	G501303760	"	200K	"	"	RNE1/4-200KJ	20 mV	10 mV
"	G501303757	"	75K	"	"	RNE1/4-75KJ	50 mV	25 mV
"	G501303722	"	36K	"	"	RNE1/4-36KJ	100 mV	50 mV
"	G501303710	"	15K	"	"	RNE1/4-15KJ	200 mV	100 mV
"	G501303729	"	3.9K	"	"	RNE1/4-3.9KJ	500 mV	250 mV
	B516100016	Knob, ϕ9mm, Black, with Line				021-222	Position	
	B516100018	Cap, ϕ9mm, Black, with Line				040-162	Position	
PCB	511310220	Printed Circuit Board				3101-07B		

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